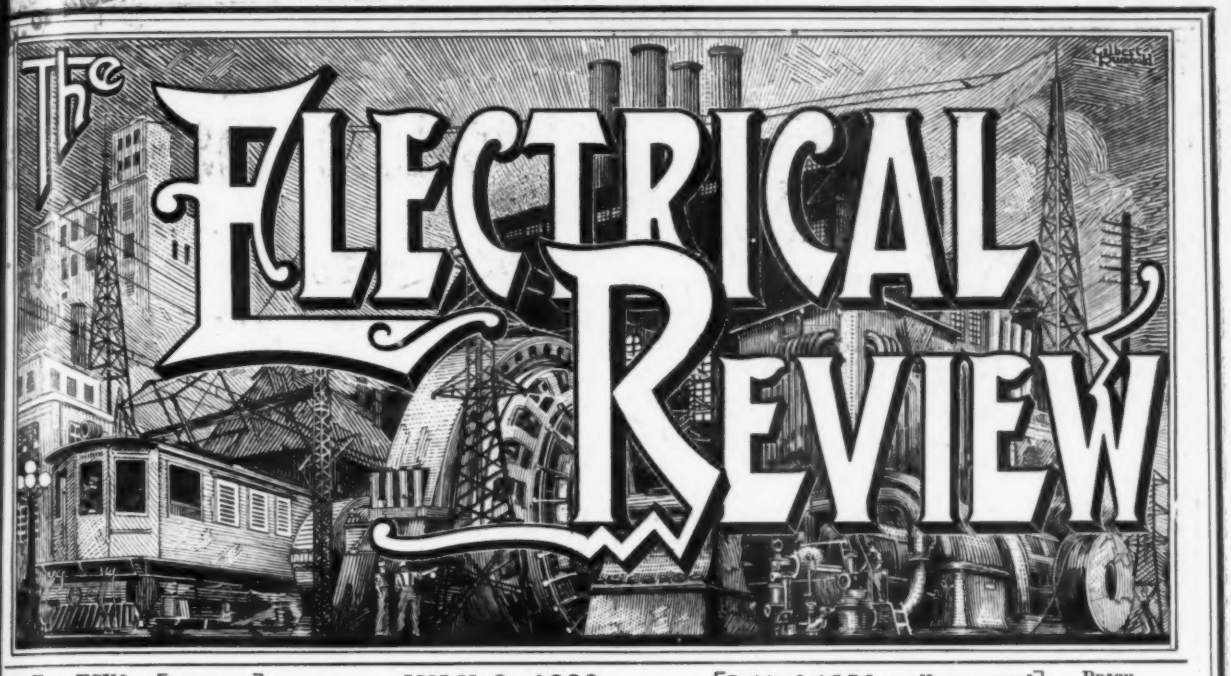

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M.E.M.
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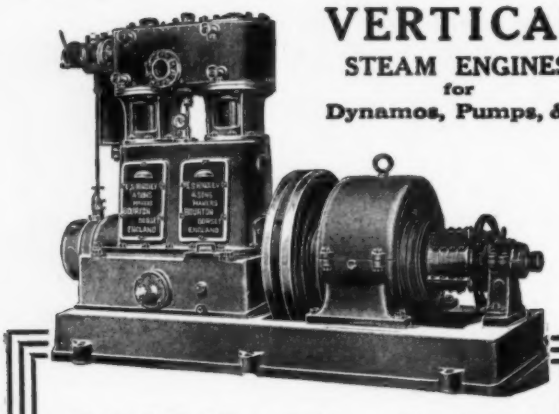

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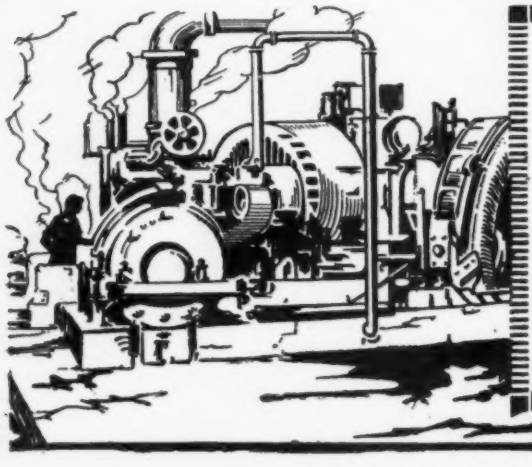

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ELECTRICAL REVIEW.

VOL. XCIII. JULY 6, 1923. No. 2,380.

ELECTRICAL REVIEW.

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THE ELECTRICAL REVIEW.

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Technical Editor: A. H. ALLEN, M.I.E.E. *Commercial Editor:* A. H. BRIDGE.

Joint Managing Directors: G. H. ALABASTER. E. A. GATEHOUSE, M.I.E.E., A.M.INST.C.E.

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THE VALUE OF DEMONSTRATION.

ALTHOUGH we have no reason to doubt that an Englishman's word is still as good as his bond, the present generation is extremely critical and increasingly sceptical, and "deeds not words" are becoming more and more necessary. Hence although the modern salesman must needs have a seductive mode of conversation, this by itself will bring little business; the present-day "seeing is believing" attitude must be satisfied. Electricity has little to fear on this account, for above all things its virtues are easily demonstrated, although it may be emphasised that the demonstrations need to be practical and convincing. We have seen pounds of French chalk sprinkled upon the surface of carpets and licked up by electric suction cleaners, and much already-clean linen treated in electrical washing machines. Very few housewives, however, do unnecessary washing, and fewer still spread powdered chalk over their floors; it is therefore very essential that only practical, everyday tests be given to the apparatus on view.

In no branch is this so important as electric cooking, which has to show up well against very cheap competitors. The absence of fumes and unpleasant odours, the ease of operation, and the excellence of the results can all be displayed in a practical way, as is being proved at Hackney. There, in the window of the Electricity Department's show-room, two "Tricity" cookers are daily operating, cooking food which is consumed by "the man in the street" or, more accurately, in local restaurants. The scheme costs the department an infinitesimal amount, while those interested can sample at their will the results of electric cooking. Mr. Robinson tells us that soon nothing but electric cooking will be acceptable to Hackney's diners-out; the restaurant proprietors are astounded at the results, and are demonstrating their satisfaction by discarding the older methods of cooking in favour of this simple, satisfactory way. The crowds that gaze intently through the window while cooking is in progress provide a great deal of interest to a student of human nature. Very few retain their initial look of doubt, and the supplanting of mere curiosity by interest is observable in nearly every case. There is no doubt that many pass on with a deeply-impressed desire to know more of electric cooking, and the terms available at Hackney are such as to bring electricity within the reach of the poorest—a veritable "cheap and abundant supply."

An ocular demonstration of a different nature but just as practical is in progress at the Liverpool showroom of the British Thomson-Houston Co., Ltd. In this instance it is lighting—a comparison of correct and incorrect methods of illuminating a shop-window. A display has been arranged by Messrs. Jacobs, the well-known biscuit manufacturers, and three separately switched lighting systems are installed. The first is the "horrible example"—two bare 100-W gasfilled lamps suspended by flexible cords; the other two are examples of B.T.H. lighting on scientific lines. These systems are switched on in turn and do a vast deal more to convert a tradesman to a proper appreciation of the right method than sheaves of polar curves. We are well aware that the examples quoted are not altogether unique; but

they undoubtedly provide an opportunity for pointing out that there is need for a great deal more of this effective form of publicity.

Helping the Consumer.

When electrical men talk or write about "the consumer" of electricity, there is a sort of superior detachment which suggests that it is always the "other fellow" about whom we are thinking—whose interests we have at heart and who we are anxious to be able to describe as "satisfied." But electrical men—and women—are electrical consumers—or they should be! The only good point that can be advanced by way of excuse for their continuing to consume gas is the valuable practical experience that they derive from being customers of a gas company with all the petty annoyances, shortcomings, escapes, smells, explosions, and what nots, that are the penalty. It is sometimes as well that those whose ambition it is to create satisfied consumers of electricity should have experienced the trials of those who are unsatisfied with the service of gas authorities. But it would be a mistake for us to run away with the notion that gas suppliers are all indifferent to the needs of their clients—far from it. There are numerous evidences that gas suppliers in various places are setting many an electricity department laudable examples of attentiveness to the consumer—his or her complaints, difficulties, wishes, preferences, comforts and conveniences—and of expedition in carrying out connections and new installations, investigating complaints regarding quarterly accounts, and so forth. The psychology of the consumer is a very important study, and electrical men can better understand the subject if they reflect upon the experiences of their wives and households with regard to other essential everyday services. From the mistakes of others we may learn what to avoid if we aim at giving satisfaction with our own commodity and service. If we are out for real popularity for electrical service, we shall do well to make the consumer's lot a happier and an easier one free from mystification, overcharging, irritation, and so forth. Everything must be done to make the way to the electric supply offices sufficiently attractive to induce the public to avail themselves freely of it. Encourage the electrical habit, custom, or fashion—"all roads lead to———." To allow them to believe that they are not wanted, because of apparent apathy on our part or because we are too busy thinking about larger customers, is reprehensible. We know of areas where electricity supply has been available for nearly two decades, and householders owning their own residences have never once been asked to take supply. Some of them are sure to go on waiting until they are approached; then they will begin to think electrically. Some suppliers are content to let main-laying operations speak for the department instead of employing live canvassers. In our opinion there is room for thousands of canvassers more than are employed. There are hundreds of capable electrical men on the look-out for jobs, and we believe there are hundreds of canvassing jobs waiting for men if we proceed ambitiously with reasonable development schemes. Publicity literature, advertisements, and other such agencies are all very well, but though they can speak, they cannot answer questions, they cannot make appointments for women to call at the showrooms, they cannot tell you what is required for your particular house, nor can they tell you the cost of what *you* want.

Safety First.

On June 19th, in London, a conference was opened of the International Labour Organisation and Industrial Health, arranged by the League of Nations Union, and presided over by Mr. W. L. Hichens.

Mr. J. H. Thomas, in addressing the meeting, said that the bringing together of employers and workpeople, including the different staffs, and compelling them to hammer out among themselves things that were of vital importance to employers and workers, would tend to clear away many misunderstandings. Suspicion and jealousy were largely responsible for the present difficulties in the labour world. Moreover, many wars were caused by trade rivalry, so that if the question of labour could be discussed on an international basis, it would be better for all concerned. It would be absurd and ridiculous, he continued, for any trade-unionist leader to say that an employer was indifferent to human life. At the same time, on the ground of common sense, it was the duty of employers to see that the maximum protection was given to their workers, and the fact must be brought home to the men themselves that they had equal responsibility with the employer. The International Labour Office could help by giving information and assisting to bring home the dangers to the minds of employers and workers alike.

Lieut.-Col. J. A. A. Pickard (general secretary of the British Industrial "Safety First" Association) read a paper on "Safety and Protection in Industry," and pointed out that a Bill dealing with workmen's compensation was now before Parliament, amending certain defects that at present existed. Probably compensation costs would be increased, and so the prevention of accidents was incumbent on all. There was still any amount of scope for a far greater reduction in accidents than had yet been achieved. Much remained to be done in the way of the provision of safeguards, but the bigger task was to ensure that the workers made full and proper use of such safeguards as were provided, and exercised reasonable personal carefulness. "Safety First" did not interfere with management. Nor was it a campaign of cranks, as the roll of its followers showed.

The subject of "Industrial Fatigue" was discussed (Mr. W. Graham, M.P., presiding). Mr. D. R. Wilson read a paper, and among those who spoke were several whose names will be familiar to readers of the Electrical Review, including Dr. C. S. Myers, Dr. Bond, Dr. T. M. Legge, of the Home Office, Sir Thomas Oliver, and others.

The "Safety First" question has received more attention in the last few years than ever before, and that in many directions. We are all familiar with the numerous attempts that have been made to induce the pedestrian to walk on the left of the pavement; with the notices, Babel-like in their linguistic variety, of the London General Omnibus Company; and with other manifestations designed to save us from ourselves. While there is room for doubt whether the injunction as to walking on the left will cause the careless or hurried to look to the right when stepping off the kerb, and so make sure if the road is safe, it must be obvious to everyone that there are many ways in which the safety of the general public could be better looked after than is the case at present. The shocking account of the death of a young lady who was knocked down and fatally injured by a railway carriage door, opened before the train was at a standstill, causes one to wonder why the use of sliding doors cannot be adopted on main-line trains as it is on the much more crowded tube trains. We shall never eradicate the particular type of fool who sails into Victoria or Liverpool Street standing on the footboard, with the carriage door coming along like the blade on the wheel of a Boadicean chariot, so why not see to it that he cannot injure anybody but himself? Again, the French, as we noted some considerable time ago, have entirely done away with the use of gas for train lighting. Yet new rolling stock continues to be built in this country, and old stock repaired, with this antiquated and dangerous system. The installation of an electrical cooking outfit on one of the Great Northern expresses some two years ago (writing from memory) has not been followed by its universal, and indeed compulsory, adoption by all railways for all trains. Truly we are a long-suffering people!

But there is nothing in the law to compel people to use common-sense, and it would be very difficult to make

and enforce such an enactment. Indeed, the provision of safety devices seems to indicate that the use of this most uncommon faculty is not expected. It means that the thinking how to avoid accidents must be done in advance, and we are therefore entitled to expect that it shall be done by experts, and done properly. Any increase in the number of associations for promoting considerations of safety, and of the persons actively interesting themselves in the work, is all to the good; and as we have indicated before, membership of such bodies as the National Institute of Industrial Psychology and the League of Nations Union can be had at a very small cost, which is surely well repaid by the thought that one is doing at any rate a little for the promotion of causes that are exceedingly worth while.

Tramways and Road Maintenance.

At the end of every financial year of the municipal tramway undertakings the vexed question of the burden of road maintenance crops up, and the publication of the L.C.C. Tramways report, in particular, reminds us how heavy this burden is. The report, which is reviewed elsewhere in this issue, is notable for the great financial improvement which it records; a loss of £89,000 was converted into a profit of £230,000, in the face of reduced fares. This is very satisfactory not only to those immediately concerned, but to the rest of the tramway industry, being testimony to a fact that is often disputed—that tramways are not obsolete and uncommercial. It is a great pity that the daily Press has been unable to give as much prominence to last year's profit as it did to the deficit incurred in the previous year.

Apart from this striking reversal of the financial position, there is much food for thought in the Highways Committee's statement that the saving to road authorities, due to the obligation of maintenance borne by the tramways, amounts to £269,500 a year. The figure is an estimate based upon the present mileage and on the normal standard of maintenance. Now, while the roads have to be maintained by the public in any event, including the people who use the cars, it is unfortunate that such a large proportion of the cost should have to appear in the accounts of the tramway undertaking. Tramways are thus made to appear to those who cannot see through the actual figures to be expensive concerns, bearing hardly upon those who, perhaps, are forced to use them, and this view is naturally fostered by those in competition with the system. To those, however, who are aware of the unfair burden thrust upon the tramway undertakers, the actual figures of costs are *only* figures, and they know that tramway "losses," when they are incurred, are very frequently other people's gains.

Supply Progress in Paris.

According to the report of the Compagnie Parisienne de Distribution d'Electricité, the consumption in 1922 increased by 24 per cent. over the preceding year, and amounted to 250,356,000 kWh in round figures. At the same time, the number of customers rose by 17 per cent., as compared with 1921, and exceeded 320,000 at the end of 1922. The progress made last year has continued in 1923, seeing that the company records an increase in the consumption of 21 per cent. in the first quarter as compared with the corresponding three months in 1922. The "A" programme of expansion of the generating stations, which was prepared in 1920, is expected to be completed for the lighting season next winter. It comprised the addition of plant of 120,000 kW by the installation of four turbo-alternators of 30,000 kW. The "B" programme, which was settled in agreement with the City Council of Paris, is in course of execution. It provides for the addition of three new sets of from 30,000 to 35,000 kW to the plant at the Saint-Ouen station. The completion of this extension will raise the total power of the company's works to 360,000 kW. Simultaneously with the expansion of the generating capacity, the work of developing the primary and secondary cable networks has been proceeding, and it is estimated that the two programmes will have involved a total expenditure of 535,000,000 fr.

I.E.E. Council Election.

The ballot papers having been issued, and only one nomination for the office of president having been received, Dr. Alexander Russell will in due course be declared elected to that office, and will take up his duties on October 1st. In conferring this high honour upon the Principal of Faraday House, the Council has done honour to itself. The distinguished services which Dr. Russell has rendered to the electrical industry have not hitherto received due recognition—largely because of his extremely modest and retiring disposition; we are glad therefore that the opportunity has been taken to give expression to the esteem in which he is held by those who are aware of his achievements.

Sir James Devonshire as vice-president will enjoy relief from the burden of the honorary treasurership, in which capacity he is worthily succeeded by Mr. P. D. Tuckett.

As the ballot papers are to be returned by to-morrow, the fate of the other nominees is by this time, may we say, a *fait accompli*.

Die Castings for Electrical Work.

Great progress has been made in die casting within recent years, and vigorous efforts have resulted in castings being produced by British firms which are quite equal to those made in America and on the Continent. Early last year it was announced that the Non-Ferrous Metals Research Association and the Research Association of the British Motor and Allied Industries were considering the possibility of taking up the subject, and their recent decision to do so should be welcomed by every section of engineering—not least by electrical engineers. In this connection it is worthy of note that the British Electrical and Allied Industries Research Association is giving its support. Both metallurgical and mechanical questions are involved.

It has not been found practicable to die-cast brass or bronze; claims have been made both in America and in this country in this connection, but they have not been substantiated. Dies are made of cast iron and alloy steel, and a suitable die alloy has not yet been found for such metals. Castings which are sound, accurate, and reliable depend on many factors apart from the constitution of the casting alloy. Quick release of the dies is necessary, and the rate of setting of the casting is very important. Practically all research work undertaken up to the present time has been done by individual firms, and they are naturally not disposed to disclose their methods.

Die castings are exceptionally suitable for making the small parts of magnetos and electrical fittings. An aluminium bronze is probably the most suitable alloy for high electrical conductivity, but despite all the claims that have been made for aluminium alloy castings, claims that are largely justified, it must be admitted that there is room for improvement. The outstanding virtues of die castings are low initial cost and the elimination of machining operations. Inserts, which may be defined as metal parts of steel, iron, or bronze which have a high melting point and are surrounded by die-cast white metal, are now much used. In the case of magneto frames, in which the pole-pieces are cast in place, the latter are made of cast-iron or laminated iron and furnish the required magnetic field which the white metal cannot supply. There are many problems awaiting solution, and it is to be hoped that every section of engineering will support the efforts of the Research Associations and thus further a process which has great possibilities.

D

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ANNUAL CONVENTION.

(*Continued from page 1034.*)

The New President.

In Mr. S. E. Britton the Association has a president who may confidently be relied upon to maintain the dignity and reputation of that high office, and to devote himself unsparingly to the onerous duties and responsibilities of chief executive officer on behalf of the municipal electricity supply undertakings.

Photo by] MR. S. E. BRITTON, President of the I.M.E.A. [*Lafayette.*

Mr. Britton, who was educated at the City of London School, was privileged to receive his technical training in the works of a firm of pioneers in electrical engineering—Messrs. Crompton & Co., Ltd., Chelmsford—where he remained for five years. He then became assistant electrical engineer to the Southampton Corporation. Proceeding to Barking as chief electrical engineer and manager to the Urban District Council, he carried out several extensions. Next Mr. Britton was appointed burgh electrical engineer at Motherwell, when Prof. Kennedy was constructing the power station and laying mains; he took over the work for the Burgh Council, and inaugurated the electricity supply, which rapidly developed and necessitated important extensions each year. Three years later he transferred i is services to Chester, where he has held the post of city electrical engineer for 19 years.

During that long period Mr. Britton carried out additions to the steam power station, mains, and public lighting, and designed and constructed a hydro-electric station on the River Dee, which was described in the ELECTRICAL REVIEW of October 17th, 1913. This hydro-electric installation was a pioneer scheme, and owing to its great success created new interest in the value of low-fall water power for the generation of electricity.

Since the Electricity (Supply) Act of 1919 was passed, Mr. Britton has taken an active part in the attempt to improve the existing organisation for the supply of electricity in the North Wales and Chester district.

In 1921 he completed negotiations with the War Office for the use of the electric power station at H.M. Factory, Queensferry, for the supply of electricity to Chester. This necessitated the erection of a transmission line from Queensferry to Chester, and the provision of three rotary converter sub-stations in the city, at a cost of £51,000; this installation was described in the ELECTRICAL REVIEW of December 23rd, 19 The station has since been purchased by the Chester Corporation for £54,000.

During 1922 a scheme was prepared for extending the Corporation's area of supply, and in April last the supply was inaugurated in Hoole and Newton-by-Chester; further developments are taking place in the direction of Saughall and Mollington.

During the war Mr. Britton was engaged in several important undertakings for Government departments. For the Ministry of Munitions he designed and constructed an electric power station and extra-high-pressure overhead transmission line feeding three underground pumping stations for un-watering five lead

Photo by] THE INCORPORATED MUNICIPAL ELECTRICAL

mines in North Wales, and he inaugurated and managed the National Shell Factory in Chester; he reported on fuel consumption to the Board of Trade, and for the Board of Agriculture and Fisheries he investigated the utility of the water power of 50 miles of the River Dee for the generation of electrical energy. (See ELECTRICAL REVIEW, May 30th, 1919.)

A member of the I.M.E.A. since 1901, Mr. Britton has served two terms of three years on the Council; he has also been a member of the Institution of Electrical Engineers and the Institution of Mechanical Engineers since 1903. His genial personality and *savoir faire*, combined with an intimate knowledge of the conditions obtaining in municipal electricity supply and of the affairs of the Association, ensure that he will be a popular president, and will successfully conduct the proceedings of the Council during a year which will be of exceptional importance in the history of the Association.

Transmission and Distribution of Electricity by Overhead Lines.

By J. EDWIN STORR, A.M.I.E.E., A.M.I.Mech.E.

(*Abstract.*)

(*Continued from page* 1034.)

It is advisable to consider the value of galvanised work for top hamper and the top section of the pole in order to extend the period between paintings where it is difficult to have lines out of commission. With adequate supervision a pole can be painted with the line alive from a point, say, 4 ft. below the conductors.

Lattice masts are particularly advantageous in wet ground. They can be erected on a concrete foundation block which is finished just above ground level and be bolted down for stability, and the shorter length of mast will make some saving in cost towards the cost of the concrete work.

Probably the greatest advantage of lattice masts is their flexibility, which permits such masts to have freedom in the direction of the line, and relieve extraordinary stresses due to torsion should a wire break. A small deflection will increase the sag to such an extent as to reduce the risk of permanent damage to a minimum.

Concrete poles can be built wonderfully flexible; 900 hollow poles 61 ft. long were recently made for a Swedish contract. A test load of 6,750 lb. caused a deflection of 4 ft. 6 in. without cracks or permanent deflection. When the load was increased to 7,600 lb. a deflection of 10 per cent. of the pole height was attained without breaking. The cracking of concrete poles has been largely overcome by moulding the poles under centrifugal force.

The most simple bracket is the swan neck for screwing direct into the pole, and for low pressure work with light conductors it is an economical item if designed for correct location of the conductor relative to the portion screwed into the pole.

For pressures above, say, 2,000 volts the necessary clearances cannot be provided except by brackets or channel cross arms. Bent flat iron brackets with a suitable stay between insulator position and pole, fixed to the pole by coach screws, make an excellent mounting.

Cross arms are used where still larger clearances are required and are cheaper than large brackets in fabricated ironwork. Wide flanged sections give ample space to receive the insulator pins, which must pass through both flanges. Stability for long cross arms against excessive overhang is secured by using a stay as in bracket construction. Bent cross arms should be avoided, as their use prevents the fixing of satisfactory bird guards.

It is not considered advisable to fix insulators on the top of poles. Bolt holes near the top open out the fibres and permit access of weather; pole caps are not so readily fixed nor so effective as on a plain pole top.

Except for very high voltages, the distance apart of conductors is governed only by physical conditions. Consideration will include span length, and consequently the sag, the arrangement and weight of the wires, and windage on the wires. Heavy lines require less mechanical separation than small gauge wires and copper less than aluminium. The heavy wires swing in closer synchronism than do light wires. Alternating-current lines must be kept closer than is required in direct-current work to reduce line losses due to inductance to a minimum. A minimum clearance for low-pressure work for spans of, say, 70 yards should be 12 in. vertical or horizontal.

A formula giving good average results is given as:—

Distance between conductors in inches = span in feet x sag in ft. ÷ 20 for pin insulators.

In long-span work the conductors should not be erected in a horizontal plane, and in no case (with the possible exception of short-span work in streets) should wires be fixed vertically one over another. This is to avoid contact by extra sag due to snow loading one wire and not another, or a number of birds may load a line to make contact with an unloaded lower one.

The author's experience with 2 ft. 3 in. spacing on 70 to 90-yard spans with Nos. 1 and 1/0 s.w.g. conductors has been quite satisfactory, although the dimensions given are much below the figures generally recommended.

Clearance between conductors and supporting structures, stay ropes or guarding must be ample to prevent accidental earthing by birds, accumulation of snow, &c. Not less than six inches should be allowed in low and medium pressure work, and for 11 kV not less than nine inches. The clearance from conductor to surface of supporting bracket or cross arm should not be less than the distance from the conductor round the insulator sheds to the pin.

The arrangement of conductors on the poles or masts is generally determined on mechanical grounds to guard against clashing or contact, and on electrical grounds to obtain a good balance of self-induction.

Vertical and horizontal arrangements of conductors involve too wide centres for mechanical reasons, and consequently high losses, and should be avoided.

In transmission work on long spans the so-called tipped triangle which is indicated in (A) fig. 3 for a 3-phase line may be used, and a very satisfactory balance is obtained. Alternative proposals (B) and (C), fig. 3, satisfy the triangular arrangement, but are less satisfactory than (A) because of the wider centres required due to vertical and horizontal wires.

Conductor arrangements for double-circuit poles can be satisfactorily planned on the tipped-triangle suggestion as indicated in (A), fig. 4. The arrangement of six wires on two arms (B), fig. 4, has the defect of horizontal wires, but it is a common six-wire arrangement and involves a long bottom arms if the two middle wires are of opposite phase. An arrangement shown in (C), fig. 4, is very satisfactory where there is sufficient spacing between wires to maintain the equilateral formation. In this arrangement the mutual induction reduces the total induction considerably.

Stay ropes of high tensile steel are generally used (45/50 ton quality). Such ropes are more subject to deterioration than lower grade material. A somewhat higher factor of safety should be allowed to compensate for reduced strength, in order to avoid too frequent replacement.

When struts are provided in lieu of stays, great care must

ASSOCIATION AT SCARBOROUGH. *Walter Scott.*

be taken in proportioning the ground loading, having in mind the small area of pole base. A substantial wooden foot is required to distribute the ground loading.

Both stays and struts should be fixed at not less than a 45-degree angle with the pole, if space permits, and 30 degrees is a minimum.

Struts at an angle of 30 degrees are often arranged to keep the unsupported length of stay at a minimum; in such case it is necessary to provide a kicking block at base of pole, or a substantial stone filling between the pole and the nearest undisturbed earth, transverse to line route to give the necessary reaction to the top pull on the pole (see fig. 5A). Special precautions should be observed at the pole junction with the strut to give ample bearing surface without cutting too deeply into the pole for the purpose. A band strap is a much better attachment than a through bolt.

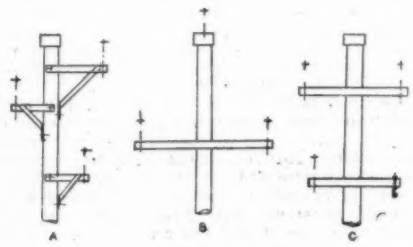

FIG. 3.

On the top of steep hills, where poles are frequently overloaded, the judicious use of stays makes the top pole into a good anchor-pole erection.

Where turnbuckles are used on stays, to prevent horned animals from becoming fastened therein, a half-round timber secured to the stay fittings by galvanised wire is effective. A Vee stay coming down to one bow nut should also be protected.

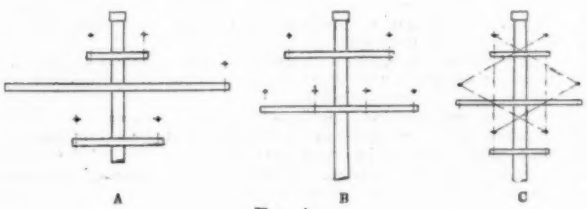

FIG. 4.

Before fixing the cattle guard the thread on the stay-rod bolt should be protected from deterioration by painting it with a mixture of tar (45 parts) tallow (45 parts) and pitch (10 parts).

Anti-climbing devices are as important on stays as on poles, and a length of stout barbed wire should be wound about the stay rope over a length of, say, four feet above the bow nut.

The Regulations call for an insulated or earthed stay. Except in the light line work the former is not satisfactory, but if used, a tramway strain insulator meets the requirements. For heavy stay loading efficient earthing is more satisfactory. In this case a conductor of ample cross-section should be laid up in the make off, and be connected to the general earthing system of the line, as fig. 5B.

Specification No. 137, issued by the British Engineering Standards Association, details the requirements of standard insulators, particularly in reference to the testing of supporting (pin type) and tension (disk type) insulators. The specification has very wisely left open all questions of shape, mounting and detail, probably with the view to avoiding any curtailment in design or manufacture.

Porcelain insulators are now most commonly used. Glass has been abandoned as too brittle satisfactorily to meet rapid changes, as, say, from hot sunshine to chilling rain during a thunderstorm. Composition insulators are finding a number of supporters, some of whom report most favourably on the results obtained. Composition insulators are particularly suitable for mechanical requirements, especially for tensioning units. This kind of insulator has still to be proven as to self-cleaning properties, and the effect of surface discharge if dirt accumulates on it.

An insulator should be mechanically strong, and of a shape that avoids deep corrugations on the under surface, which, if dark, will harbour insects and make it difficult to keep them clean. The insects attract birds, which cause interruptions in seeking their quarry.

Single piece insulators are preferable to multi-piece, and avoid the grave risks due to the use of cement. One-piece pin insulators are available for 16 kV, and for the conservative practice adopted in this country make an excellent unit for 11 kV working pressure.

The shape of an insulator must be such as will permit arcing-over to occur without heating and injury; it is claimed that the low type of insulator more satisfactorily meets this condition than the taller insulator, and the resultant larger diameter satisfactorily increases the resistance of rim to pin discharge.

Beyond a certain voltage the suspension insulator is much cheaper and has certain electrical advantages over the pin type. The size and weight of a pin-type insulator increase out of all proportion as the voltage increases.

Present practice favours disk suspension insulators for 66 kV and upwards, but the advent of longer spans and heavier conductors warrants serious consideration of the many advantages of this type for the generally accepted standard working pressure of 33 kV.

It is most important that the fixing of the insulator to the pin be done in such a manner as to prevent slack insulators on the spindles, or burst insulators will result from growth of the pin due to oxidisation and subsequent expansion. Screwed ferrules fixed into the porcelain to receive the spindle have proved to be very unsatisfactory because of growth of iron or the dehydration of the cement used for fixing, setting up internal stresses which have been sufficient to burst the insulator.

Hemp serving on the spindle head as a cushion to the porcelain has been extensively used with fairly satisfactory results.

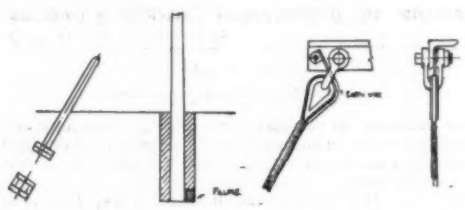

FIG. 5.

The serving requires very careful impregnation to keep out the weather, and some skill in fixing to secure a thickness of the serving exactly correct in diameter to avoid slackness at a later date, or bursting the insulator because too much packing has been forced into the hole. The great disadvantage in the use of the hemp packing is the necessity to remove pin and insulator together from the line for replacement, as it is impossible to apply the packing satisfactorily in position. A fixing medium has recently been devised by Mr. G. V. Twiss, in which the resilient effect of a hemp packing is taken advantage of by enclosing layers of hemp in a soft metal capsule which hermetically seals the hemp from the weather and short circuits any air pockets in the hemp. The porcelain and spindle have rolled round threads, and the capsule takes up any irregularity in the porcelain thread and forms a resilient medium between the porcelain and the spindle.

Considerable trouble has been experienced recently due to the use of cement in fixing insulators on the spindles. Cement is very variable in quality, and much care must be exercised in its selection and use. Special cements are available, but some are chemically active on the metal of the spindles. Other cements have too wide a range of expansion to be safe for porcelain work.

In fixinfi external fittings the cement is a safer medium than it is for internal work, owing to the stress on the porcelain being compressive instead of expansive as in internal work.

Departure from a straight line on a pin insulator is not recommended for angles of more than a few degrees, the tension insulator making a much more satisfactory job.

Shackle insulators in porcelain are to be avoided. The through spindle or bolt is constantly under conditions of deterioration, and unless regularly painted it will soon be of such diameter due to growth of metal as to burst the insulator.

Fittings for tension insulators must be carefully selected and tested, and an ample margin of material allowed to meet any deterioration. Delta IV metal or its equivalent is an excellent metal for such fittings, but care must be exercised to keep electrolytically active metals from contact with each other.

The correct position of the conductor on the insulator for straight line work is in the top groove of the insulator. In this position the weight of the conductor and the stress due to the wind are taken off the binder. In negotiating angles on pin insulators it is necessary for the conductor to occupy the neck groove.

The binding-in of conductors is a most important operation and should only be done by skilled men. Unequal span lengths, unequal loading of snow or ice, or numerous birds in one span and not the next, all make argument in favour of rigid binding in, to prevent the conductor creeping through to the longer or more heavily loaded span. On the other hand, it is desirable that the effects of broken wires should be counteracted by allowing the wire to slip through the binder, to relieve the torsion on the mast or pole by increasing the sag.

A mean result between the two appears to be the correct solution, such a grip on the wire being arranged as will only permit slipping through when the maximum unbalance, due to broken wires, occurs.

Hard drawn copper wires are most satisfactory for the heavier work, but soft copper is advantageous for working round small conductors.

The following sizes of wires are recommended:—

Conductors No. 10 s.w.g. to No. 4 s.w.g. Binders No. 13 s.w.g.

Conductors larger than No. 4 s.w.g. Binders No. 10 s.w.g., or multiple of number 10's.

Copper-clad steel is useful where maximum strength is required, but the use of steel pliers on this material must be forbidden.

A word of warning is necessary regarding the collection of every scrap cut from wires of all kinds. These find their way into cattle food or are picked up by grazing animals.

Earthing work is of two distinct kinds:—

(*a*) For operating purposes, *e.g.*, middle wire and the neutral of polyphase systems.

(*b*) For protection to prevent potential rises above earth on supporting structures.

Earthing work should be carried out with the same care as conductor work, as if the work is neglected in the former it may only be ascertained after a fatal accident, while carelessness with conductors shows itself in operation. Earth plates buried in rocky ground or even submerged in water must be avoided.

The connections to an earthing system should be ample to prevent danger and a false sense of security. The cross sectional area of an earth conductor should bear a proper relation to the current it may have to carry, and cannot be considered satisfactory if less than a No. 3 s.w.g. copper wire or its equivalent. Copper wires should preferably be tinned and steel wires heavily galvanised.

The connection to the earth plate or cone should be given special attention. Cast-iron plates are the cheapest to install, but are electrolytically active to the usual connecting wires, and consequently precautions should be taken to secure a good and permanent connection and render the whole connection waterproof. Copper electrically coated on C.I. plates and bonded connections make a substantial earthing arrangement. As a precaution, it is advisable to protect important earth wires when within reach by a non-conducting covering.

All earth wires should be run as straight as possible, avoiding angles and sharp corners.

Flat plates are preferable to buried pipes, weight for weight, as earthing points. Permanently damp positions must be obtained, or steps taken to render them so. Crushed coke 12 in. thick rammed tight around the plates is a good adjunct to an earth plate. If more than one plate is used they should be separated by a few feet, and should not be fixed at right angles to one another, thus spreading the potential gradients over a wider area.

It has been found that neglect to maintain a moist earth surround to an earth plate has resulted in the current drying up available moisture to such an extent as to dry out the surrounding ground and practically insulate the earth plate.

It is of the utmost importance that all metal work other than that intended for conductors should be permanently and efficiently connected to earth. It is, generally speaking, much more effective to run a continuous earth wire than it is to earth individual poles. The aerial earth wire may be run above or below the conductors, and in addition to earthing all supporting metal work has a protective effect against disturbance by equalising differences of atmospheric potential over high and low land. The most common arrangement is to fix the aerial earth wire below the conductors and use it for supporting other circuits. For this purpose galvanised steel strand is generally used, but if the wire is run above the conductors, as is considered preferable by some engineers for protective purposes only, it is better to use copper clad wire and eliminate any risk of the earth wire coming down amongst the conductors as a result of deterioration.

It is very desirable to provide a flexible support for the suspended earth wire to prevent breakage due to fatigue of the metal which would result from rigid supports. A correctly anchored aerial earth wire will give additional stability to the line supports and will counteract the effect of a broken conductor.

Special precautions are necessary at roads, railways and the crossings over other circuits. With the careful attention to detail which is being given to overhead work at the present time there is less need for the elaborate guarding arrangements which were in vogue until recent years. Ample protection can be given to public roads, &c., by increasing the factor of safety on fitments, and conductor supports in particular, at such crossings and ensuring that overturning of a mast or pole is impossible. Duplicate conductors, or the equivalent in bridle wires, which increase the factor of safety 100 per cent., give adequate protection. This precaution is made more effective still by the installation of earthing devices, either at the nearest pole adjacent to the roadways, &c., or by the erection of road guards immediately over the road. An arrangement of conductors with bridle wires suitable for the supporting type of insulators, or alternatively tension insulators, is shown in fig. 6, the conductors being carried from pole to pole on short span work and tied together at short intervals; or they are provided with bridle wires clamped to the main conductors, the bridle wire acting as an additional support. This double conductor arrangement was introduced by Mr. A. P. Trotter.

The right-hand side of fig. 6 shows an earth bar arrangement to make dead a falling wire, while the left-hand side shows a road guard with earth wires crossing the road to serve the same purpose as the brackets. The bridle wires should, for the safety of the extra insulator, be carried back over to the other side of the mast, otherwise there is a danger

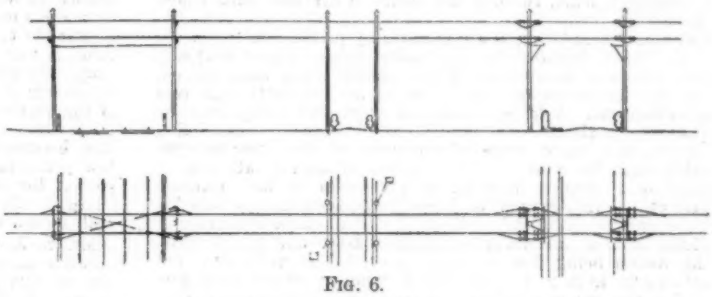

FIG. 6.

of the insulators falling thorugh the building-up of potential on the end insulator due to atmospheric disturbances, switching, &c.

A plain road guard, permitting line poles to be spaced according to normal span instead of (for the sake of the guarding) fixing them at each side of the road, proves more economical and enables the full equipment of insulators, &c., at each side of the road to be dispensed with. These simple devices are much more satisfactory than the cradle cages used in the past, which in a high wind were a real menace to the safety of a line. Earthing brackets should be well earthed and heavily galvanised. To protect lines from bird trouble a fibre tube is placed on the cross arm and held in place by the insulator spindle.

Instead of guarding open wires at important crossings a length of underground cable can be inserted. Experience has shown that, if satisfactory cable terminal boxes are used, there is no danger in doing this, but the cost is heavy.

Telephone circuits on the same line of poles as the power conductors are not satisfactory, the line being often inoperative at times when it is most wanted. Telephonic circuits are largely used made up as a cable and supported on the aerial earth wire, but such construction is costly and adds seriously to the loading on the supporting structures. Considerable attention is being given to the pioneer installations now being operated with "carrier currents" or "wired wireless" telephonic apparatus in which the communications are transmitted over the power conductors.

(*To be concluded.*)

Discussion.

Mr. S. J. WATSON (Salford) said that a satisfactory underground cable for 66,000 volts had not yet been designed and overhead work for that pressure was likely to find a good field. Overhead transmission had not perhaps been of such importance to municipalities with their delimited areas as to the power companies, but the matter would be of increasing importance in the future. The only way in which supply could be taken into the remote districts was by means of overhead lines, owing to the greater cheapness. There were many advantages in an overhead line, especially on a long run when one had to dodge to and fro over a river or canal and things like that; in such cases an underground cable was an impossibility. Again, overhead lines were the only possible means when crossing hills or between points where a straight main road run did not exist. After all, the outlying districts were as much entitled to a cheap supply of electricity as the more fortunately situated areas. The importance of wayleaves could not be overstated, and the need for some methods of negotiating them was obvious. He mentioned a case in which he had been compelled to lay a mile of underground cable instead of half a mile of overhead line and, of course, the consumer had to pay, as he always had to in such cases. As to the greater reliability of underground mains as compared with overhead lines, which was often stated, he was one of those who thought there were limits on the price to be paid for reliability, although he would always have in view the satisfaction of the consumer. He was quite prepared to admit that, generally speaking, the overhead line was not as reliable as the underground cable, but troubles were comparatively rare, and if the overhead lines were run in duplicate they would have done all that could reasonably be expected to ensure an efficient supply. So far wooden poles had been entirely used in this country owing, no doubt, to the short

spans generally adopted, but as to the use of reinforced concrete poles, he should have thought that that was not a material which would have any flexibility. He did not like the author's scheme (fig. 4), which seemed to show one conductor on one side of the pole and two conductors on the other side. It was very desirable to arrange matters so that a broken insulator could be easily replaced without making both the supply lines dead, but according to the arrangement in fig. 4 it would be necessary to send a man up the pole to replace a broken insulator whilst one of the lines was under pressure, and that would be a risky thing to do. Insulators should not be of white material, as they formed an admirable cock-shy for the small boy. He had used insulated overhead wires on a housing scheme, running the insulated overhead lines round the houses under the eaves, thus reducing the cost considerably and making the job a commercially possible one.

Mr. W. B. Woodhouse (Yorkshire Electric Power Co.) said that overhead distribution was becoming fairly standardised, the only unsatisfactory feature being the relatively high cost of switchgear. A large amount of work was being done by both the B.E.S.A. and the Electrical Research Association on overhead work, some of the work of the latter not yet being ready for publication, but it was of such a nature as to warrant a greater financial support than it had received hitherto. In addition to issuing specifications for wooden poles and insulators it had been decided to adopt a pressure of 45,000 volts as intermediate between 66,000 and 33,000 volts, the reason being that in some cases 33,000 volts was not sufficiently high to be economical, whereas 66,000 volts precluded the use of combined overhead and underground conductors. This decision had been come to at the recent meeting of the International Electrotechnical Commission. The B.E.S.A. was also at work on conductors, preparing specifications for hard-drawn copper and aluminium and the Research Association had also been doing some very interesting work on that subject. It had been found, for example, that the effect on elasticity of repeated stresses on a cable was to increase the limit of proportionality. They had also found a very interesting relationship between the strength of individual wires and the strand made up of seven or more wires, whilst a very interesting research had been carried out on a cable made up of a steel core surrounded by aluminium. That cable was in very general use in other parts of the world. It was a very valuable cable and it was important to know how it would behave in relation to the two metals reacting to the stresses. They had been allowing more for wind pressure than circumstances warranted and, as a result, they would be able to lighten their structures. Supports to foundations were an important matter about which information would shortly be available. Then as to wayleaves, although the industry had compulsory powers, great care must be taken in the way they were exercised. It would be a valuable thing if the Association and other associations representing supply authorities could draw up a standard wayleave agreement. The Commissioners would listen sympathetically to any such procedure, he was certain. With reference to the author's table of comparative cost of overhead and underground lines he did not see why there should be a difference of some £500 per mile as between 6,600 and 11,000-volt overhead wires.

Mr. J. W. Burr (Swansea), who spoke from the point of view of a municipal electrical engineer who had just started using overhead wires, said that, small as his experience had been, he had come to the definite conclusion that overhead lines were certainly not so reliable as underground cables. Some time ago his council desired to supply a group of collieries some 12 miles out of Swansea and it was decided to erect a 33,000-volt line. The supply had been given for about 12 months and he had had a considerable number of interruptions due to birds and lightning. He was not speaking of interruptions lasting a few minutes, but those lasting 13 and 14 hours. The importance of reliability in such a case was such that if the ventilating fans at the collieries stopped for five minutes the men had to run for their lives, and once they were out of the pit they would not go down again that shift. The men were, in fact, getting discontented, and complained that there were many more interruptions since they had taken the public supply than when they had their own plant at the colliery. Considerable expense was being incurred in protecting the line from interruptions due to birds, but he had been told that nothing more could be done as regards protection against lightning. As to wayleaves, one often came up against an obstinate farmer who would not let one put up a pole at any price, and in such cases he felt it was better to make a detour, because otherwise it meant a fight and expense.

Mr. S. R. Sivjour (Yorkshire Electric Power Co.), said there was sometimes a tendency to use light poles to save expense, but that was false economy more often than not owing to the need for providing for future development. Earthing was a most important point, and owing to the varying strata in different parts of the country it was essential that the earthing should be as efficient as possible. Although overhead lines could not be said to be absolutely as reliable as underground cables, still, if a duplicate line was installed and the lines were sectionalised, that got over the trouble of momentary interruptions. In Yorkshire they claimed to have educated birds. It was a fact that although birds were a trouble at first they were not now: they seemed to have become more learned and kept away from the overhead lines.

Councillor J. W. Collins (Mayor of Birkenhead) pointed out that outlying districts were not entitled to a supply unless they put down a substantial sum of money to show their interest in it. Then as to overhead lines, he hoped some consideration would be had for the amenities of the district. Concrete poles were being used to a very large extent throughout the world, but they wanted to live as well as use electricity. It was true there were Government powers for compulsory wayleaves, but they were rather suffering from Government powers and were very rapidly approaching a state of nationalisation, or State socialism, which was repugnant to the English character.

Mr. H. Bell (Hull) said that the difficulties with regard to wayleaves were much greater in the English shires than they were upon moorland. In the cases of arable land it was quite impossible to get permission to run a line in a straight direction; it was often necessary to wind the route much in the same way as a cable route, and thus a good deal of the advantage of an overhead line was lost. The lesser reliability of the overhead line must apply in the very nature of things. Birds were a real trouble, but he believed it was a fact that they became educated in the course of time. During the past few years there had been a sort of concerted action on the part of the unified railways to very much increase wayleave charges. He agreed that there should be some unity of effort with regard to a standardised wayleave agreement.

Mr. R. A. Chattock (Birmingham) said the figures of comparative cost governed the whole matter. He presumed the figures were per mile, and in the case of 33,000-volt cables the figure was £3,800 for underground and £1,080 for overhead lines. Reckoning the capital charges at 7 per cent. for interest and sinking fund it showed a difference in favour of the overhead line of £190 a year, but against that had to be set the greater maintenance charges on the overhead line. Ferro-concrete structures were very flexible indeed, and he had seen a ferro-concrete pole 70 ft. long hung in the middle with a curve of 4 ft. out of the straight, yet it had not cracked. Another great advantage of the ferro-concrete pole was that it did not require painting. Duplicate overhead lines would be necessary on the score of reliability, and that fact had to be taken into account in comparing the costs of overhead and underground mains because with the latter they could rely on a single, or ring, main to do what was required.

Mr. A. H. Dykes said that they would never have the same amount of distribution by overhead lines in this country that there was abroad. In those parts where overhead wires were used they would have to accept, as part of the price of supplying outlying districts cheaply, something less in the way of reliability. If they wished absolute continuity then they might as well use underground mains at once and have done with it. The same reliability could not be obtained even with duplicate overhead mains. As to the comparative costs, everything must depend on the particular circumstances. At Karachi the soil was a very easy one for laying underground mains, but a very difficult one for making foundations for poles, and so it happened that underground mains were actually the cheapest to the extent of 25 per cent. Again, in India, wooden poles could not be used owing to the trouble from white ants, and steel was essential. A hurried decision, however, could not be come to in any case and all the circumstances had to be considered. As to concrete poles, experience seemed to show that the length of their life depended upon the care with which they were made. If one could get an absolutely reliably-made concrete pole it was the best. The use of aluminium for conductors instead of copper was a matter of relative cost. The engineers for the electrification of the Oudh and Rohilkhand railway in India had given the contract for aluminium for the overhead line because in that case it was distinctly cheaper than copper.

Mr. Storr, briefly replying to the discussion, said that the comparative costs of overhead and underground cable work were merely indicative of the difference between the costs of the two forms of construction. In the case given in the paper the same size of copper had been taken and priced accordingly, but the figures were not a real comparison. He would, however, extend the table and also add figures of the cost of maintenance. Moulded insulators in thousands were in use in this country, chiefly in the Swansea area and on the Cornish Power Co.'s lines. There was also a good deal of aluminium conductor work in use here. Had Mr. Burr put up bird guards his trouble would have been avoided. The worst features of lightning trouble were due to elevation; if a line had to pass over a prominence, then trouble from lightning was always greater, and in those cases it was better to go round below. A careful selection of the route enabled one to avoid a lot of possible disturbance due to lightning. Attention must be paid to appearance because they could not expect to get support for any undertaking which went direct against the public. In connection with wayleaves and arable land, difficulties were not so great as were often imagined. It was only right that, if they went across arable land, they should expect to pay more than in the case of other types of country, but his experience was that although the British farmer would grumble at anything, he was quite reasonable if tackled in the right way. The best policy was to be quite frank and put all their cards on the table when they went to discuss the matter of wayleaves with the landowners or tenants. The secret of concrete poles was centrifugal moulding, without punning or ramming.

COST AND DESIGN.

BY FREDERICK W. POPE.

IF the cost office is doing its work in the right way its activities should be felt in every department of the factory—and not least in the drawing office.

The problem of cost and design is too wide to be fully covered in a brief article, but there are aspects of it which might well be considered by directors and managers of engineering firms.

It goes without saying that the head draughtsman should not be kept in ignorance of any cost records in which he may be interested. This might be readily admitted—might indeed be passed over as a platitude—but it is important that the idea be incorporated as part of the routine.

This is not to suggest that the firm's confidential accounts should be thrown open to all and sundry. The head draughtsman need only get statistics in percentages and proportions; these will tell him quite as much as the actual figures would.

The aim of every manufacturing firm is that its product shall be cheap (relatively, of course) and efficient. Works are reorganised with the object of cheapening production, but scientific organisation is only one of two arms. Design is the other.

The cheap motor-car is an obvious and popular example of this.

The question is really one of analysis.

All industry is, in the ultimate, the application of labour to material. Whatever the tools or the processes, labour fashions material into such shapes and forms as are useful or artistic—or both. In the engineering branches of industry it is necessary that the material shall be brought to its useful state with a minimum of expense, and the designer who has struck the right balance between labour and material costs has won the secret of cheap and efficient design.

How can we strike the right balance in the case of an electric motor? First, by analysing the cost. Find out what the machine costs in labour and in material and what percentage these bear to the total cost; parts also may be analysed in the same way. The whole process is interesting and should not be difficult where records have been carefully kept.

Next, the question may be passed on to the technical and practical men. Is the design as simple as it might be? One thing to be looked for is excessive time spent on machining, winding or fitting; another, breakdowns on test. Any or all such things may be due to a needlessly complicated design.

While material cost is not likely to be much disturbed, investigations into labour costs may cause parts to be altered with a view to facilitating the work upon them. Labour cost will thus be reduced—and running expense in the same proportion.

Lest there be any, even in these days, who confuse reduced labour costs with reduced employment, the fact may be stated: cheap production will lead to increased demand. The cheap motor-car may again be instanced; it has created a demand where none existed. The electric motor will, in due time, do the same.

The designer, looking beyond his drawing board, visualises the finished machine. But he must do more than this. In co-operation with the administrative staff, he must do what he can to perfect such a design as will be, at once, simple and efficient.

This Week's Short Story.—A correspondent sends the following short story, apologetically adding that he cannot vouch for its accuracy:—"The driver of a 'Ford' car having experienced trouble with his lighting equipment, pulled up before the gates of an imposing public building in Cromwell Road, at about 9 o'clock on the evening of June 28th, and addressing the policeman on duty at the gates, he asked to be directed to where he could obtain the services of a competent electrician. 'Lor' bless you, Sir,' replied the jovial constable, 'you're in luck, we've got a whole institoot full of 'em inside 'ere to-night!'"

PARLIAMENTARY NOTES.

[By Our Special Parliamentary Reporter.]

Railless Trolley Systems.—On June 26th, Sir WALTER DE FRECE asked the Parliamentary Secretary to the Ministry of Transport how many railless trolley vehicle systems there were in this country; and whether, as a rule, they were working satisfactorily.

Col. ASHLEY replied that, according to the latest information available, there were at present 11 railless trolley vehicle systems open for traffic in Great Britain. In addition, in 19 cases the necessary statutory powers had been obtained but had not been exercised, and in two other cases systems which were formerly worked had ceased working. With regard to the last part of the question, he would refer his hon. friend to the Return of Tramways and Light Railways (Street and Road) and Trackless Trolley Undertakings recently issued by the Ministry of Transport.

High-power Wireless Stations.—On June 28th, replying to questions put by Mr. Becker, Sir L. WORTHINGTON-EVANS said that a licence from the Postmaster-General was required by Section 1 of the Wireless Telegraphy Act, 1904, for the erection of high-power wireless stations. The conditions now being negotiated with the Marconi Co. would not exclude competition by other companies, nor would they create a monopoly for that company. He hoped to lay the agreement on the table of the House as soon as it was completed.

City & South London Railway Dispute.—On June 28th, Mr. MCENTEE asked the Parliamentary Secretary to the Ministry of Transport whether he was aware that the tunnellers and labourers who were engaged on the reconstruction of the City and South London tube railway ceased work about a month ago as a consequence of a dispute with the contractor, and that the dispute still continued; whether, as a consequence of the unfinished condition of the tunnel, there was reason to believe that the tunnel was unsafe for the running of trains; whether any steps were being taken by His Majesty's Government to bring about a satisfactory settlement of the dispute, and whether he would take steps to prevent the further running of trains in this tube until steps had been taken to ensure public safety.

Colonel ASHLEY said that the dispute arose out of a reduction of wages which was agreed to by the Civil Engineering Construction Conciliation Board. He understood that the unions concerned were not represented on this board, but that the board had offered to meet in order to hear the claims of the men, provided that work was resumed. Officers of the Ministry of Labour had been in touch with the parties throughout the dispute, but in the circumstances the Minister of Labour was not in a position to intervene. He was informed that the dispute had not in any way affected the safety of the tunnels on the railway.

The Channel Tunnel.—On May 28th, the PRIME MINISTER informed Mr. Leach that the Government was not at present prepared to consider the question of a Channel tunnel.

The Rutenberg Concession.—On July 2nd, Mr. BECKER asked the Under Secretary of State for the Colonies if any progress had been made this year towards harnessing the latent water power in Palestine under the Rutenberg concessions; and if any electrical energy had been produced.

Mr. ORMESBY-GORE said that he was informed that considerable progress had been made under the Auja Concession, which was the only concession that had actually been granted. The power house had been erected, and cables and transformers had been installed in Tel Aviv and Jaffa, where the current was now available. In anticipation of the supply, 225 applications for connections had been received up to June 28th, including many from Arabs. The supply of current began on that date.

Wireless Stations.—On July 2nd, the POSTMASTER-GENERAL informed Sir R. B. Chadwick that the capital expenditure in connection with wireless stations was approximately as follows:—Leafield, £115,000; Cairo, £136,000; Northolt, £43,000; and Stonehaven, £31,000.

Private Bills.—The London County Council (Money) Bill, the Oakham Gas and Electricity Bill, and the Torquay Corporation Bill have been read a third time, and the Shropshire, Worcestershire, and Staffordshire Electric Power Bill a second time in the House of Commons.

THE SUPPLY OF ELECTRICITY IN NEW DISTRICTS.

The Sales Point of View.

BY R. E. GAMLEN.

Broadly speaking, the whole question of supply in new districts may be summed up under three headings:—

(*a*) Before laying the mains.
(*b*) During the laying of the mains.
(*c*) After laying the mains.

Before the sizes and routes of the initial mains can be fixed, a fairly accurate estimate of the probable load should be made, so that the most economical cable sizes can be calculated. This can be done by making a survey of the district, that is to say, estimating the load simply by surveying the streets and averaging the number and demand of possible consumers. This method can only be very approximate, but it has the advantage of being much easier and quicker to execute. Another method is by canvassing the area and interviewing each potential consumer with the object of ascertaining his demand. To do this, several representatives should be employed, as the work is very wearying, the tediousness being considerably lessened if the interviewers "hunt in couples." I have purposely avoided the use of the word "canvasser" as applied to those who undertake this work, the title of "sales representative" being much preferable. The representative should be competent to advise prospective consumers as to their installations and should have had some technical training, so that he is in a position to meet any questions that arise.

The greater the care taken in the preliminary estimate, the more the economy that will ultimately be gained; for it ensures that once a main has been laid in a street it will not require to be strengthened at an early date, as is sometimes the case. In order to bring this about, members of the sales department should look ahead and keep their eyes open to all possible future demands and to the ultimate expansion of the districts.

As an example of the advantage of looking ahead, the case of cooking can be cited. Many people may not be able to afford the cost of a cooker at the outset, or may for other reasons—generally financial—refuse to install one; here then the supply authority's representative will determine whether or not, according to his judgment, the consumer will purchase one at some future date. It must be the representative's business to sum up the position after his talk to the householder. If it is fairly obvious that he will change his mind later, then a service of ample size should be installed so that the necessity of re-opening the ground is obviated.

It may be found that the following table is of use in deciding service sizes, assuming 3-phase, 4-wire supply at 200-240 V, for lighting, heating and cooking:—

Consumer's Name.	Lighting. Pres.	Lighting. Future.	Heating. Pres.	Heating. Future.	Cooking. Pres.	Cooking. Future.	Total. Pres.	Total. Future.	Service. Size.
Smith ...	3 kW	3 kW	3 kW	3 kW	Nil.	Nil.	3·3 kW	3·3 kW	·0145 2 core
Jones ...	3 kW	3 kW	2 kW	4 kW	,,	,,	2·3 kW	4·3 kW	·0145 4 core
Robinson ...	3 kW	3 kW	Nil.	4 kW	,,	4 kW	3 kW	8·3 kW	Ditto.
Brown ...	3 kW	3 kW	2 kW	6 kW	4 kW	6 kW	6·3 kW	12·3 kW	·022 4 core

Here the ultimate (estimated) load can be seen, and the service size can be fixed immediately. The advantage of being able to stock three standard sizes of cable is obvious, and it greatly assists the speeding-up of the work of connection.

Of course, this optimistic estimating can be carried to excess; moreover, the high diversity which is obtainable with a cooking load must not be lost sight of. According to Mr. W. A. Gillott, this figure is of the order of 9, which is extremely satisfying for mains engineers, since it does away, to a great extent, with the fear of overloading the mains.

Some weeks before the actual work is commenced a sales representative should concentrate on the district, calling on the residents by appointment, with the object of finally ascertaining their requirements, so that there will be the minimum delay in connecting them when the cable is being laid. The possibility of being able to connect all the consumers in one street at one time greatly lessens the cost owing to the cutting-down of transport charges. It is as well to mention here that there is a vast difference between a potential consumer who states that he is willing to take a supply, and one who has made definite application; and it is the sales representative's business to get all outstanding potential consumers finally settled. It is found that people are very likely to change their minds if not kept interested.

If possible, a local office and showroom should be opened and all operations conducted from this centre. Many people are always popping in to obtain particulars, and if there is someone in attendance, much time and trouble is saved. The desirability of equipping a showroom before the supply is actually available is doubtful, but it does enable people to get familiar with electric fittings, &c.

In opening out new districts the most essential class of consumer is the power user, and every effort should be made to get this desirable load on the mains. Even small motors of 4 and 5 h.p. are worth going after, as the more of this type there are connected, the greater will be the diversity factor and consequently a more effective use can be made of the copper.

Power users, besides being remunerative, help to flatten out the load curve, and in residential districts this is especially important. The load factor in such a district would be exceedingly poor were it not for the small power users such as garages, butchers' shops, kinemas, small engineering or manufacturing shops, and the like. The industrial peak in many manufacturing districts is far greater than the evening lighting peak, but in a residential area the reverse is the case, and no pains should be spared to collect every possible power consumer.

Although the arguments in favour of electric drives are so convincing, it is still a comparatively difficult matter to persuade potential users to look favourably on any scheme for changing over their existing machinery to this mode of drive. The great difficulty that stands in the way of this changing-over is the first cost and the scrapping of old plant. Nowadays second-hand gas and oil engines are exceedingly difficult to dispose of, and even if a sale is effected, the difference between original cost and second-hand price is very considerable. In times of dull trade, owners of workshops do not feel justified in writing off their existing power plant and at the same time making a further capital expenditure. Each potential consumer must be approached and each job considered on its merits. To do this, some figures of the old cost should be obtained and a comparison made with the cost of electricity, working on the same load factor. In this way economies can generally be pointed out, which will result in the new plant paying for itself in a few years.

There has lately been a considerable drop in the price of motors, due to the fall in wages and also to German competition. This fact has greatly helped the cause of the electric drive, and it is now an ideal time to concentrate on securing this load.

With regard to tariffs for power users, of the many methods in use all unfortunately have drawbacks. The problem of power factor, which has recently received considerable attention, is still a source of trouble. If an average power factor of 0.75 is presumed in dealing with motors, it is fairly accurate to say that 1 h.p. is equal to 1 kVA; then a standing charge can be fixed, or under another method a minimum charge per horse-power installed. In this way the supply authority has a guarantee of a certain amount of revenue from every power user. Unfortunately, the consumer himself in

times of bad trade really suffers most, for besides not running his motor and therefore getting no useful work from it—which in turn means money to him—he has still to pay the minimum sum prescribed. On the other hand, the supply authority suffers also in that it has part of its plant out of commission, and this means idle capital, which might have been put to better use.

With regard to the other type of consumers in the main streets, shops are probably the easiest to convince. The mere fact that they know a neighbour is taking a supply urges them to keep pace with him, and they realise the necessity of making their premises as attractive as his.

Banks and offices are among the first to take a supply. With public houses—very desirable consumers—difficulty is experienced in that so many are not privately owned, and delay is caused through dealing with the breweries which own them, but here again, if the example is set by one brewery, the others generally follow suit.

Private residents present a different problem, and may be divided into two sections: (*a*) those people who own the house they live in, and (*b*) those who pay rent. The former class are the more likely to take a supply, as they are putting value into their own property, but the latter section are not so easy to convince. The best means to approach this class of consumer is by an interview, the time to be chosen by the householder. This ensures that he is in a receptive mood and more likely to be interested than if the interviewer called without previous arrangement.

If possible, an enlarged map of the town should be obtained—somewhere about 35 yards to the inch—and each building numbered so that its position can be immediately ascertained. On a consumer calling at the office, his residence can be pointed out on the map, and the difficulty of location is done away with. This will enable the representative in charge to give a rough quotation for supply on the spot. As each consumer is settled up, his house should be coloured in so that the growth of the load can be seen at a glance.

Domestic tariffs are many and varied, but for any consumer who intends to make good use of his supply, that with a standing charge and small unit rate is the most popular. The standing charge may be based on the rateable value, number of rooms, or floor area of the building, and the unit charge brought as low as possible. This method enables the same meter to do for both lighting and heating; moreover, the wiring of the premises is greatly simplified. It is remarkable to note how interested people are in this method of charging, and very little trouble is needed in explaining it to them.

One difficulty sometimes experienced is the fixing of the meter position, especially if the town is low-lying and the houses have no cellars. This calls for much tact and occasionally no little argument. The electrical meter and cut-out, although not large, are not an aid to the general decorative scheme, and people are not slow to point this out. There seems to be room for improvement in this particular, especially as in many cases the apparatus has to be placed in the passage in full view of every visitor. If more co-operation with the architect were feasible in the first place, it would be possible to do away with this source of annoyance. In the future, however, no trouble should be experienced in this respect, since architects are realising the importance of providing for the installation of electricity during the actual building of the house.

The cost of wiring and of apparatus, the trouble involved, and natural prejudice against anything new, are factors that go to make up the opposition, but their treatment is somewhat outside the scope of this article.

For propaganda work, advertisements in the local paper, weekly articles explaining in simple terms the uses to which electricity may be put, and the circulation of pamphlets have been found to be useful.

Demonstrations and personal talks at the office or showrooms are invaluable as an aid to getting people interested. Perhaps that sentence sums up the position. *One must get people interested*; once their attention is secured, the rest is fairly plain sailing.

THE LONDON COUNTY COUNCIL TRAMWAYS.

Report for 1922-23.

IN common with the majority of other public services, the London County Council tramway undertaking showed a great improvement, financially, during the year ended March 31st last, passing from a heavy deficit to a substantial profit.

The Highways Committee's report, presented at last week's meeting of the Council, showed that the revenue declined from £5,167,911 to £4,909,891, but at the same time the working expenses (including special charges and renewals) decreased to a greater extent, *viz.*, from £4,597,330 to £4,038,028. The result was, therefore, a gross surplus of £871,863, or more than £300,000 in advance of the surplus realised in the previous year. The capital charges, which in 1921-22 absorbed the whole of the gross profit, and caused a deficit of £88,757, were rather lower at £641,612, and the final result was a profit of £230,251. It was proposed that £31,500 of this should be credited to the special county account in respect of income tax adjustments on account of the years 1920-21 and 1921-22, in which years deficiencies on net revenue account were made good by the rates. The balance is to be transferred to a reserve fund, as it is felt that the surplus estimated for the current year will not be such as to leave an excessive margin for contingencies.

The capital expenditure during the year amounted to £801,373; this included a sum of £233,211 paid to the London United Tramways, Ltd., for the portion of its undertaking in London. This brought the total expenditure upon the undertaking to £16,084,393, and the net outstanding debt, on March 31st, after allowing for debt repaid, sinking fund balances, and the value of surplus land, was £9,135,944.

The sums charged in the accounts for the redemption of debt have been gradually falling since 1916-17, owing to the adoption of the cumulative annuity system in lieu of the instalment system of repayment previously in force.

The total number of car-miles run during 1922-23 was 63,381,367, representing an increase of about 6.5 per cent., while the number of passengers carried increased by about the same percentage to 733,811,367. At the end of the year the system had a total route-length of 163.51 miles (122.49 conduit and 41.09 overhead).

The report states that the total paid to Metropolitan borough councils and the City Corporation during the year, as rates on the permanent way, amounted to £69,056; this was additional to rates and taxes paid in respect of offices, car-sheds, substations, depôts, &c. The saving to road authorities in consequence of the obligation to maintain the paving along the tramway routes has been estimated to amount, on the present mileage, to £269,500 per year. The aggregate amount ultimately chargeable to the tramway revenue account in respect of the estimated cost of effecting street improvements carried out along tramway routes is approximately £788,500, of which £729,000 had already been so charged up to March 31st, 1923.

The amount actually charged to the tramway revenue account during the year 1922-23 in respect of rates on tracks, and debt charges on street improvements (£29,633), together with the sum estimated at the end of the year to be saved to local authorities on maintenance of paving (at the rate of £269,500 a year), gives a total of approximately £368,188, and various rates were therefore relieved to this extent.

Opportunities in Malaya.—The *Financier* recently quoted from a report upon the possibilities of electrical development in British Malaya by Mr. F. Bolton, adviser to the F.M.S. Government. Mr. Bolton found, in 1921, that there was a strong demand for cheap and reliable electricity supplies. The provision of electricity for domestic use in all towns of any magnitude was very desirable, and the production of power was an important item in the working costs of mines. To meet about half of the estimated demand (59,000,000 kWh per annum) it is estimated that a capital expenditure of about 31,000,000 dollars (over 3¼ millions sterling) would be required. This would ultimately rise to 37,000,000 dollars (over 4¼ millions sterling) to satisfy the full demand. In 1922, the Senior Warden of Mines, F.M.S., reported that an aggregate of 15,998 kW of plant was installed, the bulk of this being employed in mining. The plant capacity rose during the year by 1,000 kW, and the Warden considered that this rate of increase was likely to continue. The Yukon Gold Company has commenced the erection of a large hydro-electric station at Batang Padang. An analysis of the machinery import figures shows that by far the largest proportion comes from the United Kingdom. The competition of the United States, once formidable, is on the decline, and there seems no doubt that United Kingdom manufacturers will be able to hold their unchallenged position.

Mining Engineering Exhibition at Cardiff.—The South Wales Institute of Engineers invites applications for space in the above exhibition, to be held from November 29th to December 8th. Last day for receiving applications August 31st. (See our advertisement pages to-day.)

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

The "Auto-Grip" Adaptor.

The ordinary form of adaptor made from hardwood commonly possesses several faults. The covers are usually fragile and liable to split; wiring is difficult, especially when large-sized flex is used; and the leading-in holes and terminals are much too close involving the risk of short circuits. An endeavour to eliminate these drawbacks has been made by Mr. J. C. White, 49, Bridge Street, Deansgate, Manchester, in what he terms the "Auto-Grip" adaptor (fig. 1). In this device each lead is gripped independently over a long path, thus avoiding the pinching together of the conductors at the point where maximum flexibility is required. The terminals are placed on the outside of the body to guard against "shorting." A large diameter hole is provided in the cap to permit the entry of the larger sizes of flex, and the terminals are of hexagon shape, giving an increased contact area. The body of the adaptor is moulded in a special fireproof insulating material which will not soften at high temperatures.

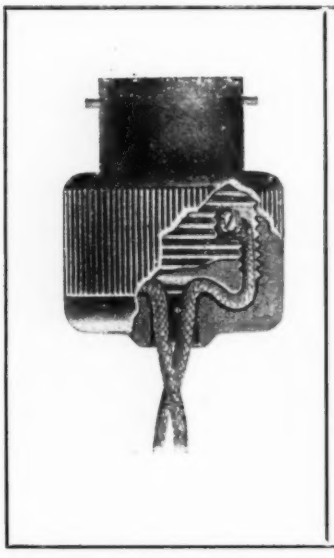

Fig. 1.—The "Auto-Grip" Adaptor.

A Miniature Searchlight.

The small searchlight illustrated in fig. 3 is a product of the London Electric Firm, Brighton Road, Croydon. The mirror is only 10 in. in diameter. Standard fittings are provided so that a dispersing lens or a signalling shutter can always be supplied as an extra from stock, and no additional fittings are required. Several different mountings are available; the cast-iron base shown in the illustration is most usual, but wood and metal extensible tripods, or gunwale and bulkhead fixings can be supplied.

Fig. 3.—A Miniature Searchlight.

A Mobile Air-compressor Plant for Road-breaking Tools.

The accompanying illustration (fig. 2) shows a portable air compressor plant for feeding pneumatic road-breaking tools, made by Messrs. Lacy-Hulbert & Co., Ltd., Boreas Works, Beddington, Croydon. The plant is mounted on a "Warren" trailer and consists of a "Dorman" 20-h.p., two-cylinder, petrol engine, driving a water-jacketed single-cylinder compressor capable of an output of from 50 to 55 cu. ft. of free air per minute at a pressure of 100 lb. per sq. in. The compressor is fitted throughout with ball and roller bearings, and the piston is made of a special aluminium alloy.

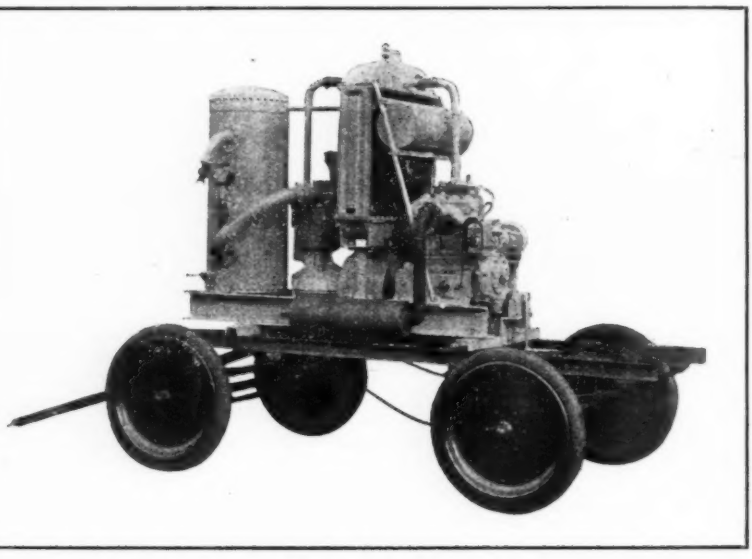

Fig. 2.—The Lacy-Hulbert Mobile Air-Compressor Plant for Road-Breaking Tools.

The plant illustrated is designed to serve two pneumatic tools and its overall dimensions are 6.5 ft. x 4 ft. x 5.75 ft.

The makers inform us that the equipment is being employed very successfully in tramway work and in the laying of electric mains.

A Time Lag Fuse.

A time lag fuse (fig. 4) is being marketed by Multiple Electric Products Co., Inc. The element is composed of four metals and all the fuses are constructed alike from 3 to 600 A, 250 V, and from 3 to 200 A, 600 V. A copper strip, or wire, on which is superimposed one or more metallic lumps of cadmium, tin, and antimony, forms the element. Under heat these four metals merge or amalgamate and form a new alloy which has a lower melting point than copper. This amalgamation takes time and it is this which causes the delayed action.—*Electrical News* (Toronto).

Fig. 4.—A Time Lag Fuse.

Long-Range Reception.—A user of a two-valve radio receiving set, with reaction, made by Messrs. Rogers, Foster and Howell, Ltd., reports good results. The set is in use at Silloth (Carlisle), and "loud clear reception" is obtained from the Eiffel Tower "any day or evening" with very little distortion. The distance is about 550 miles. Telephony from all the British broadcasting stations has been received perfectly. Another client, who has a three-valve set, states that he can hear the three Paris broadcasting stations very clearly, and on one occasion received telephony from America.

BUSINESS NOTES.

Bankruptcy Proceedings.—HARRY BERNARD WEST, 3, Clyde Street, Canterbury, electrician.—The receiving order in this matter was made on May 16th on debtor's own petition. The statement of affairs shows liabilities of £195 against assets of £7 10s. Debtor attributes his failure to insufficiency of profits to meet business expenses and the fact that he had been living beyond his private means. The first meeting of the creditors was held on May 26th at the Official Receiver's office, 10, Burgate Street, Canterbury, when the case, being a summary one, was left with the Official Receiver as trustee. The following are creditors:—

	£		£
Electricity Manufacturing Co. ...	75	Terry, S.	54
Philpot & Son	15		

L. CONTAMIN, motor and electrical engineer, 9, Wingate Road, Hammersmith, W.—Receiving order rescinded June 22nd, all debts having been paid in full.

F. S. RIPPINGILLE, agent for electrical fittings, Winchester House, Victoria Square, Birmingham.—First meeting July 11th at the Official Receiver's office, 191, Corporation Street, Birmingham. Public examination July 18th at the Court House, Birmingham.

R. WRIGHT (R. Wright & Co.), electrical engineer, 34-36, Oxford Street, W.—Receiving order made June 28th, on creditor's petition. First meeting, July 11th. Public examination, August 21st, both at Carey Street, W.C.

E. E. MEARNS, electrical contractor, 14, St. Bede's Road, East Boldon.—Receiving order made June 30th, on debtor's own petition.

T. R. W. WYNESS & G. W. BALE (Wyness & Bale), electrical engineers, 13, Commercial Street, Brighouse.—Last day for proofs for dividend July 18th. Trustee, Mr. C. H. Baker, 1, Albion Street, Leeds.

T. R. W. WYNESS (separate estate), electrical engineer, 16, Crossley Street, Leeds.—Last day for proofs for dividend, July 18th. Trustee, Mr. C. H. Baker, 1, Albion Street, Leeds.

Company Liquidations.—BRITISH RADIO-WIRELESS MANUFACTURING CO., LTD., Electric House, Wardour Street, London, W.—A meeting of the creditors was held on Tuesday, at Winchester House, E.C., when Mr. G. W. Burgess, C.A., of 14, St. Mary Axe, E.C., the liquidator in the voluntary liquidation, submitted a statement of affairs, which showed liabilities of £2,258. After allowing £49 for preferential claims, the assets were estimated to realise £1,330, or a deficiency as regarded the creditors of £928. The issued capital of the company was £2,000, and as regarded the shareholders, the deficiency was £2,928. Mr. Burgess reported that the company was registered on November 2nd of last year, and shares to the extent of £1,400 had been issued for cash and were fully paid. He had not had time to make an exhaustive investigation into the company's affairs, but he understood that trouble had arisen with customers through the supply of faulty apparatus, while in some instances unsuitable stock was purchased. Since its inception, the company had only made a gross profit of £67, while the expenses of the business had been £1,573. The deficiency was attributed to the loss on the trading, together with the writing-down of the assets for the purpose of the statement of affairs and the elimination of the goodwill, which stood in the books at £650. No directors' fees had ever been paid, and two members of the board had lent the company over £1,000. One of the directors advanced £700 when the company was in low water, and an attempt was made to bolster it up, but without success, and finally liquidation took place. The creditors passed a resolution confirming the voluntary liquidation of the company, with Mr. Burgess as liquidator, while a committee was appointed, consisting of three of the principal creditors. The principal creditors are:—

	£		£
Fuller's United Electric Works	135	Re-Echo Wireless Co.	81
Graham, A., & Co.	94	Putney & Sons	45
Low, F. W., & Adler	95	Batsons, J., & Sons	40

THE NUNEATON ELECTRICAL CONTRACTING CO., LTD., Queen's Road, Nuneaton.—In pursuance of the provisions of the Companies (Consolidation) Act, a meeting of the creditors of the above was held on June 29th, at the registered offices of the company, when it was reported that voluntary liquidation had taken place, and that Mr. P. Russell, of Newdegate Street, Nuneaton, had been appointed as liquidator. The statement of affairs presented showed liabilities of £1,222, of which £1,150 was due to the ordinary unsecured creditors, the balance of £72 being in respect of preferential claims. In addition the bank was shown as fully secured creditor for £2,794, and it held securities valued at a similar amount. The assets were estimated to realise £2,319, and a surplus was thus disclosed so far as the creditors were concerned of £1,097. The assets consisted of: Cash in hand, £6; book-debts, £800, expected to produce £675; stock and work in progress valued at £1,200; and plant, machinery, patterns, motor cycle, fixtures, &c., £437 9s. It was stated that the company's business was established in 1911, and showed successful results until 1920. In view, however, of repeated trading losses since that date the shareholders had decided that the concern should be wound up. The business was being advertised for sale as a going concern. If it had to be closed down and a forcible realisation took place the stock and plant would prove a somewhat doubtful factor. In the event of a realisation the surplus would not be realised, but there should be a very substantial dividend even if the creditors were not paid in full. The issued share capital of the company was £6,750. During the last two years the directors had found something like £5,000 for the business. Latterly contracts had been lost. After discussing the position the creditors decided to confirm the voluntary liquidation of the company, subject to Mr. A. Cripwell, of Messrs. Corfield & Cripwell, accountants and auditors, Birmingham, being appointed as joint liquidator, while a committee of inspection was also nominated.

HITCHCOCK'S MAGNETIC ENGINE CO., LTD.—Particulars of claims to the liquidator, Mr. E. W. Edsall, 32, Fenchurch Street, E.C., by July 31st.

ELECTRICAL ENGINEERING AND EQUIPMENT CO., LTD.—Meeting of creditors July 12th at Winchester House, Old Broad Street, E.C. Liquidator, Mr. R. Kettle, 5, London Wall Buildings, E.C.

WHEELER'S ELECTRIC SHADE CARRIER, LTD.—Winding up voluntarily. Liquidator, Mr. V. Walker, Lloyd's Bank Buildings, King Street, Manchester. Meeting of creditors at Lloyd's Bank Buildings, July 9th.

NEON LIGHTS, LTD.—Winding up voluntarily. Liquidator, Mr. G. M. Williams, 128-132, Shaftesbury Avenue, W.1. Meeting of creditors at Shaftesbury Avenue July 19th. Particulars of claims to the liquidator by July 26th.

Dissolutions of Partnership.—BRYDEN & CURRIE, electrical engineers, Orbiston Street, Motherwell.—Messrs. H. N. Bryden and R. T. Currie have dissolved partnership. Mr. Currie, Oakfield Works, Motherwell, will attend to debts.

HULBURN & Co., electric wire and cable merchants, 42, Southwark Street, S.E.1.—Messrs. E. G. Hoare, L. E. Milburn, and J. H. Hull have dissolved partnership. Mr. Milburn will continue the business under the same style.

Private Arrangement.—SAMUEL GEORGE HOLBROOK, HENRY FREDERICK REED, and GEORGE ROBERT SAUNDERS, trading as the F. S. R. Instrument Co., dealers in wireless instruments, 20, Clerkenwell Green, London, E.C.—The creditors interested herein were called together recently at the offices of Messrs. Corfield & Cripwell, accountants, when Mr. W. A. J. Osborne reported that the liabilities totalled £224, while the assets consisted of stock-in-trade, fixtures and fittings estimated to realise £30. The liabilities included a claim for £50, money lent by the wife of one of the partners on April 19th last. A deficiency account could not be presented, as the books had been lost. The business was successful in the early part of the year, the dealings in wireless sets showing a profit, but the debtors had been working under too heavy expenses. The drawings of the partners had ranged from £10 to £12 a week for the three, while the gross profits had been insufficient. A resolution was passed in favour of the assets being immediately realised under an authority from the debtors and the proceeds distributed *pro rata* amongst the creditors. The following are creditors:—

	£		£
Brisco, W., & Co., Ltd. ...	11	Holland, Hannen & Cubitts,	
Dart Spring Co., Ltd.	13	Ltd.	25
Morgan Ebonite Co., Ltd. ...	44	Lawson, Ward & Gamage, Ltd.	11
Holbrook, Mrs.	50	Moores & Griffiths, Ltd. ...	51

Trade Announcements.—MR. A. C. SCOTT, lately sales manager of the British Driver-Harris Co., Ltd., has commenced business on his own account as A. C. Scott & Co., Ltd., specialists in alloys for electrical resistances, at 89, St. James' Street, Manchester. A circular has been issued relating to "Cromaloy" and other electrical resistance alloys.

MALLEABLE FITTINGS, LTD., is removing its works and offices to 208-210, Stewarts Road, Wandsworth Road, London, S.W.8, where it is putting down plant extensions. Telephone No.: "Brixton 3123."

MR. B. E. WHITE has removed to 47a, Pomeroy Street, New Cross, London, S.E.14. Telephone No.: "New Cross 2566."

MR. H. M. BRYDEN, late of Messrs. Bryden & Currie, electrical engineers, is carrying on business in Orbiston Street, Motherwell.

MR. R. WOODWARD, having opened new premises and showrooms at 61, Kew Road, Richmond, Surrey, asks for catalogues and price lists of lighting and heating accessories, private plant, &c.

MESSRS. CARGILLS, LTD., export merchants, Balfour House, 119-125, Finsbury Pavement, E.C.2, wish to receive manufacturers' latest catalogues, terms, &c.

MESSRS. VICKERS-PETTERS, Ipswich, have appointed Mr. A. P. Laughland as their Midland representative. The offices are at Union Chambers, Temple Row, Birmingham.

The London office of LE TRANSFORMATEUR SOCIETE ANONYME has been moved to Abbey House, 2-8, Victoria Street, S.W.1.

Catalogues and Lists.—MESSRS. DODGE BROS. (BRITAIN), LTD., Stevenage Wharf, Stevenage Road, Fulham, S.W.6.—An illustrated booklet dealing with commercial motor vehicles in some detail.

MESSRS. HANS RENOLD, LTD., Burnage Works, Didsbury, Manchester.—An illustrated brochure upon the selection of chain-driving gear.

THE HAMWORTHY ENGINEERING CO., LTD., 76, Victoria Street, S.W.1.—A priced and illustrated pamphlet dealing with air compressors for direct or belt drive.

MESSRS. RIPAULTS, 1, King's Road, St. Pancras, N.W.1.—A priced and illustrated list of Leclanché cells, both "wet" and "dry."

THE BENJAMIN ELECTRIC, LTD., Brantwood Works, Tariff Road, Tottenham, N.17.—The "Benjamin Bulletin" for June, containing notes and articles upon the firm's products and their applications.

MESSRS. BRUCE PEEBLES & CO., LTD., Edinburgh.—Pamphlet No. 22 B, containing exhaustive details of polyphase induction-type motors.

MESSRS. A. P. LUNDBERG & SONS, 477-489, Liverpool Road, Holloway, N.7.—A priced leaflet illustrating flush tumbler switches for radio-telephony apparatus.

PREMIER TELEPHONE CO., 62, Oxford Street, W.1.—A priced and illustrated pamphlet advertising the "Mello" light-weight head-'phone.

THE ENGLISH ELECTRIC CO., LTD., Queen's House, Kingsway, W.C.2.—Publication No. 414, containing an illustrated description of the "Fullagar" oil engine for land purposes.

METROPOLITAN-VICKERS ELECTRICAL CO., LTD., Trafford Park, Manchester.—Fan advertising matter, including a cardboard "cut-out," a booklet giving technical and selling information, an illustrated booklet giving a description of the fans, and an attractive folder. Leaflets Nos. 61/1-1, "Industrial Drum-type Controllers"; 61/3-1, "Watertight-type Drum Controllers"; and 51/1-3, "Direct-Current Motor Starters, Type S.D." Also circular No. 1,061/1, giving very complete details of drum controllers of various patterns. All fully illustrated.

THE SUN ELECTRICAL CO., LTD., 118-120, Charing Cross Road, W.C.2.—List No. 39, giving prices of "Sunco" electric fans.

THE CAMBRIDGE & PAUL INSTRUMENT CO., LTD., 45, Grosvenor Place, S.W.1.—A mailing card bearing illustrations of standard cells (Weston normal pattern).

THE BRITISH THOMSON-HOUSTON CO., LTD., Crown House, Aldwych, W.C.2.—An illustrated and priced pamphlet dealing with "Mazda" gasfilled projector lamps.

MESSRS. ROGERS, FOSTER & HOWELL, LTD., Edward Road, Balsall Heath, Birmingham.—A folder describing the firm's two- and three-valve radio receiving sets, with reaction, loud speakers, &c.

BRITISH CENTRAL ELECTRICAL CO., LTD., 6 and 8, Rosebery Avenue, E.C.1.—An illustrated booklet describing turbines, condensers, de-aerating plant, &c., made by the firm's principals, Messrs. Richardsons, Westgarth & Co., Ltd.

MESSRS. HYATT, LTD., 56, Victoria Street, S.W.1.—An illustrated descriptive pamphlet upon "N. D." front-wheel hub bearings.

SIEMENS AND ENGLISH ELECTRIC LAMP CO., LTD., 38-39, Upper Thames Street, E.C.4.—July trade price-list of lighting fittings, lamps, switches, fuses, fires, dry cells, accumulators, cables, and other electrical accessories.

MESSRS. L. G. HAWKINS & CO., LTD., 116, Charing Cross Road, W.C.2.—A circular letter and pamphlet announcing details of the "Universal" "summer outfit campaign."

For Sale.—Southampton Corporation electricity department has for disposal a quantity of d.c. house-service meters. St. Helens Industrial Co-operative Society invites offers for surplus plant and machinery. Aldershot Corporation Electricity Department has for disposal two 80-kW Willans-Parker generating sets, one 135-kW Carels-Peebles Diesel generating set, and two Babcock & Wilcox superheaters, complete with all valves and fittings. (See our advertisement pages to-day.)

British Industries Fair, 1924.—It has now been officially announced that next year's Fair will be held from April 28th to May 9th, instead of during February, as usual, for the convenience of visitors from abroad to the British Empire Exhibition.

A "Kaleeco" Film.—During the present week Callender's Cable & Construction Co., Ltd., is exhibiting a film entitled "Wiring In," at the Holborn Cinema, W.C., depicting the application of the firm's "Kaleeco" wiring system.

Ash-removal Plant for Morwell Station.—The order for the ash removal and dust extraction plant for the new generating station at Morwell, Australia, has just been received by Messrs. ED. BENNIS & CO., LTD. The plant comprises a complete pneumatic suction ash and dust extraction plant, including auxiliary and accessory equipments in two duplicate sets, each set being for the purpose of removing the ashes, soot and flue dust from a range of six water-tube boilers and chimneys, with three chain grates per boiler, being 18 chain grates for each unit, or 36 grates for the complete plant. The plants are to be interconnected, so that either will serve either range of boilers. Each plant is to be capable of removing the ashes from the boiler-house to the storage bunkers at the rate of six tons per hour. The contract includes two ash receivers, each of 2,400 cu. ft. capacity.

American Electrical Exports During April.—While the total value of electrical goods exported from the United States during the month of April, 1923, exceeded by $1,201,368 the total for April, 1922, it was $363,651 less than for the month of March, 1923. Shipments during April were valued at $5,981,191, bringing the total for the first four months of this year to $23,439,714, which is $4,460,457 greater than the total for the same period of 1922. Notable strength was shown in the exports of telephone equipment, large alternating-current generators and fractional horse-power motors. Considerable decreases, as compared with the previous month, were noted in power transformers and insulated wire and cable exports.—*Commerce Reports.*

To Secure Shareholders' Co-operation.—We have already referred to the valuable support that shareholders of electrical companies are able to render to the businesses in which they have an interest by "pushing" the sale of their products among their friends and business connections. The chairmen of several companies have pressed the matter home in speeches. The non-electrically-informed shareholder, in order to use his influence intelligently and profitably, must first be brought to know something about the products turned out by the company in which he is an investor. The General Electric Co., Ltd., has prepared a booklet of some 32 pages addressed "to the shareholders of the G.E.C.," and entitled the "G.E.C. and its Products." It is being circulated with the copies of the annual report of the directors, which is abstracted in our "City Notes" to-day. The booklet, which is well produced, contains small photographs of the company's numerous works, particulars of its branches, its overseas addresses, and its lamps, broadcasting apparatus, fans, heating and cooking appliances, electric light fittings, bells, telephones, country-house lighting plants, and of its larger work as well.

British Trade Mark Applications.—The following are included among the recent applications for British trade marks. Objections may be lodged within one month from the dates mentioned:—

Sacophone. No. 434,870. Class 8. Sets of instruments and apparatus for use in wireless telegraphy and telephony.—The Standard Automobile Co., 67-71, Manningham Lane, Bradford. June 27th, 1923.

S. G. Lead Hydrate (lettering and design). No. 434,426. Class 8. Electric accumulators, not for medical purposes.—Siebe, Gorman & Co., Ltd., 187, Westminster Bridge Road, London, S.E. June 27th, 1923.

Weconomy. No. 435,019. All goods in Class 8.—The Western Electric Co., Ltd., Norfolk House, Victoria Embankment, London, W.C. June 27th, 1923.

Trade mark consisting solely of design No. 435,706. Class 8. Apparatus for use in telephony and telegraphy.—General Wireless, Ltd., 21, Garrick Street, London, W.C. June 27th, 1923.

L. K. (lettering and design). No. 433,871. Electrical goods in Class 13.—Elkay Electrical Manufacturing Co., Ltd., 4, Southampton Row, London, W.C. June 27th, 1923.

Credenda Zincenamel Quality Conduit (lettering and design). No. 434,930. Class 13. Conduits.—Credenda Conduits Co., Ltd., 29, Whitehouse Street, Aston, Birmingham. June 27th, 1923.

Meiwo. No. 435,941. Class 13. Sparking plugs.—Thorneley, Gibson & Co., Ltd., 142, Wool Exchange, London, E.C. June 27th, 1923.

Weldrops. No. 436,254. Class 13. Electrodes for welding purposes, and electrical fittings.—Weldrics (1922), Ltd., Bush Lane House, Bush Lane, Cannon Street, London, E.C. June 26th-27th, 1923.

Annual Outing.—The Yorkshire Electric Power Co.'s fourth annual outing and children's sports took place on Saturday, June 23rd, at the Rectory, Thornhill (by the kind permission of the Rev. H. T. Hayman), and proved one of the most successful yet held, brilliant weather favouring the gathering, which numbered approximately 700. The children's sports were enjoyed to the full, and at the close of the events, prizes were awarded to the successful competitors by Mrs. W. B. Woodhouse. Tea was provided, and before leaving the ground each child was presented with a toy.

Copper and Lead Prices.—Messrs. F. Smith & Co. report, July 3rd:—Copper (electrolytic bars), £72, 50s. decrease; do., do., sheets, no change; do., do., wire rods, £82, 50s. decrease; do., do., H.C. wire, 10 3/16d., 5/16d. decrease. Messrs. James and Shakespeare report, July 4th:—Copper bars (best selected), sheet and rod, £98, £2 decrease. English pig lead, £25 5s., 15s. decrease.

Institution of Rubber Industry: AN APPEAL.—A strongly-supported appeal for help in establishing a fund for the purpose of placing this Institution upon a firm and permanent foundation has been issued. The organisation was established two years ago, and it has now 465 members, and its subscriptions and other income approximately meets current expenditure, but it is desired to extend the lecture activities in different parts of the United Kingdom, to found a technical entrance examination, and to publish a *Bulletin* of Proceedings. For these purposes the Foundation Fund is to be built up. The object of the Institution is "to promote a better understanding and a closer relationship between all sides of the Rubber Industry." Particulars can be obtained from the secretary, Mr. W. F. V. Cox, Faraday House, 10, Charing Cross Road, W.C.2.

London Fair and Market.—The annual London Fair and Market is being held at the Royal Agricultural Hall from July 9th to 20th.

Brazilian Trade Conditions.—Imports into Brazil continue to suffer by reason of the low rate of the milreis, both Government and private firms restricting commitments wherever possible. On the other hand, exports continue satisfactory. The trade outlook, however, is still too uncertain, it is felt, to warrant large outlays upon new enterprises to which the Government stands committed. The determination to proceed, for example, with the carrying out of a number of railway extensions and other public works, notwithstanding the severe strain upon the national resources, is causing some uneasiness. . . . Trade between the United Kingdom and Brazil could be substantially benefited, it is thought, if the South American steamship services were improved, but it would appear that there is little hope of this for the present in view of the disappointing volume of traffic, both cargo and passenger. Conditions in Europe have served greatly to reduce the demand for accommodation. In view of the depressed condition of British trade with Brazil, and in order to encourage its revival, the suggestion has again been made to British exporters to grant more liberal credit terms to their Brazilian customers. During recent years American exporters succeeded in capturing a considerable share of the Brazilian trade by granting terms of 120 days from the date of shipment, and even longer credit terms to specified houses. At present, however, a proportion of the large United States exporting houses are selling on a fixed nominal basis and bearing the loss of difference in exchange solely with the idea of retaining their position in the Brazilian markets. German exporters are offering from six to nine months' credit, while the terms of French traders are usually from 30 to 90 days, but the tendency with exporters of goods other than luxuries is to draw at longer terms. —*Reuter's Trade Service* (Rio de Janeiro).

Air Compressors for the House of Commons.—The HAMWORTHY ENGINEERING CO., LTD., has recently received an order from the Office of Works for two air compressors, driven by 25-b.h.p. motors, for the House of Commons.

The Boilermakers' Lock-out.—In a statement issued last week by the Trade Union Congress it was urged that immediate steps be taken to refer the questions at issue in the boilermakers' dispute to arbitration. It is agreed that, in general, contracts entered into by a group of unions should be observed by the member bodies, but it appears to the Congress that the present agreement prejudices the interests of the boilermakers to a disproportionate extent as compared with the other unions, and special regard should have been paid to their position when the negotiations were in progress.

Book Notices.—"The Castings Magazine," June, 1923 (24 pp.). Falkirk: The Falkirk Iron Co., Ltd. Price 3d.—This is the second issue of a quarterly magazine containing articles of general interest, as well as notes of purely local concern. Among these are an essay upon "The League of Nations" and a contribution to the Shakespeare-Bacon controversy.

Messrs. Siemens Bros. & Co., Ltd., who manufactured and installed the equipment at the Southampton automatic telephone exchange, have sent us a copy of the brochure which they produced as a souvenir of the inauguration of the exchange on June 30th. A prefatory note contains a brief history of telephony in Southampton, and following this is a brief description of the Siemens system. Then comes an illustrated section describing the equipment, and the publication is completed by short chapters on "Circuit Principles" and "Traffic and Design."

The Official South African Municipal Year-Book, 1923. Joint editors, W. P. M. Henderson, Durban, and F. G. Pay, Cape Town. London: E. G. Allen & Son, Ltd. 25s.—This volume of 450 odd pages, as its name implies, contains full information regarding the South African municipalities, their operations, finances, electric light and power, water, and municipal housing undertakings, &c. In a general review, it is stated that during 1922 new electric light and power plants were installed at Alice, Beaufort West, Barberton, Burghersdorp, Ceres, Howick, Indwe, and Randfontein. Electric lighting plants are in process of erection at Caledon, Frankfort, and Robertson, for completion during 1923. The total capital expenditure on electric light and power stations (including tramway plants) is given at £8,135,429, compared with £6,830,329 for 1921. There is a series of five large folded tables inset, in which are given general particulars of electric lighting and power undertakings (population served, manager's name, source of power, generating system, distribution system, kWh sold, load factor, number of consumers, and street lighting); particulars of generating plant, price of coal, &c.; financial details, such as capital invested, cost per kW installed, revenue, capital charges, working expenses, coal costs, &c.; tariffs; municipal bulk, private company supply, &c.; also tabular details of tramway systems. All of these useful tables have been compiled by Mr. H. A. Eastman, B.Sc., A.M.I.E.E., engineering assistant at Cape Town Corporation Electricity Department. While we have naturally dwelt upon the electrical contents of the volume, it should be added that it contains much other material of a general kind which should be of equal value to those who are interested in other branches of engineering and contracting work.

"*Journal* of the Institution of Electrical Engineers." Vol. LXI. No. 319. June, 1923.—This issue contains the following:—Problems in Telephony Solved and Unsolved (the fourteenth Kelvin Lecture), by Prof. J. A. Fleming, F.R.S.; Permanent Magnets and the Relation of their Properties to the Constitution of Magnet Steels, by Mr. E. A. Watson; Power Factor: its Technical and Commercial Aspects, by Mr. H. E. Yerbury; The Pulling into Step of an Induction-type Synchronous Motor, by Mr. L. H. A. Carr; and A Bridge Method for Determining Losses at Wireless Frequencies, by Mr. M. D. Hart. London: E. & F. Spon, Ltd. Price 10s. 6d.

Scientific Papers of the U.S. Bureau of Standards No. 470, "A Method for the Accurate Measurement of Short-time Intervals"; and No. 472, "Alternating-current Resistance and Inductance of Single Layer Coils." Washington: Government Printing Office. Price 10 cents each.—The first of these papers describes a tuning-fork flashing device by which time intervals can be read with the unaided eye with an error of not more than one ten-thousandth of a second. The latter paper uses an integral equation method to develop formulæ for the a.c. resistance and inductance of a system of parallel "go and return" circuits, and these are applied to several coils in which the "skin effect" is very pronounced.

"Electricity Supply Accounts," by G. Johnson. Third edition. Pp. xx+181. London: Gee & Co. (Publishers), Ltd. Price 10s. 6d. net.

"Report of the Fuel Research Board for the Years 1922 and 1923." First Section, "The Production of Air-Dried Peat" (146 pp.; 88 figs.). London: H.M. Stationery Office. Price 5s. 4d. post free.

"The *Journal* of the Junior Institution of Engineers," July, 1923 (pp. iv+44). London: Percival Marshall & Co. Price 2s.—The principal paper reproduced in this issue is one entitled "An Introductory Survey of Modern Theory and Practice in Estimating Pipe Line Losses for all Fluids," by W. Fordham Cooper, B.Sc. In addition to this, proceedings at local Centres are recorded, and there are reports of visits, reviews, &c.

There is only one *Punch* in all the world. The Summer number, just issued (1s.) is quite good. A large part of it is illustrated in colours.

Forthcoming Exhibitions.—The following exhibitions are being organised:—

LONDON.—August 31st to September 22nd, Shipping, Engineering, and Machinery Exhibition; September 8th to 14th, Bakers' Exhibition; October 15th to 20th, Motor-Cycle and Cycle Show; November 22nd to December 1st, Motor Exhibition.

CANADA (*Toronto*).—August 25th to September 8th, Canadian National Exhibition.

CZECHO-SLOVAKIA (*Prague*).—September 2nd to 9th, International Samples Fair.

BELGIUM (*Namur*).—September 1st to 17th, Commercial Fair.

HOLLAND (*Utrecht*).—September 12th to 25th, Industries Fair.

ITALY (*Turin*).—September 8th to 30th, Patents and Industrial Improvements Exhibition. (*Naples*).—September 16th to 30th, International Industries Fair.

JAPAN (*Osaka*).—September 12th to October 20th, Communication and Travelling Exhibition.

JUGO-SLAVIA (*Ljubljana*).—September 1st to 10th, International Trade Fair.

MADAGASCAR (*Antananarivo*).—August 15th to September 15th, International Commercial Fair.

NORWAY (*Christiania*).—September 2nd to 9th, Industries Fair.

RUSSIA (*Moscow*).—August-September, Agricultural Exhibition and Fair.

SWEDEN (*Gothenburg*).—August 20th to 21st, Trade Fair.

TRIESTE.—September 3rd to 24th, International Samples Fair.

URUGUAY (*Montevideo*).—December, Industries Exhibition.

A South African Electrical Law Suit—and After.—The *Cape Times* gives the following interesting account of the experiences of the plaintiff and the municipal-councillor defendants in a lawsuit heard some time ago in the Supreme Court before Mr. Justice Watermeyer. The case was Wilkinson *v.* Trevett, and Wilkinson *v.* C. J. de Villiers and others, and the place in which the trouble arose was Beaufort West, Cape Province:—"Mr. Wilkinson, who is an electrical engineer, claimed damages from Mr. Trevett, who was in charge of the municipal electric scheme, and from the Mayor (then Mr. C. J. de Villiers) and councillors in respect of a letter written by Mr. Trevett and published in the local paper, which he claimed was damaging him in his business. He won his case against Mr. Trevett, but lost his case against the councillors. The costs of the case amounted to £1,228 odd. Some time after that Mr. Wilkinson became insolvent, with the result that the whole amount of the costs had to be defrayed by the councillors, who, it must be pointed out, had been summoned individually, and not as a council. These councillors then applied to the council, as a body, for a refund of the amount disbursed. But in the meantime there had been changes in the council—amongst others, a new Mayor, Mr. Vincent Starbridge, had been elected, Mr. de Villiers having refused to be nominated again. The council now passed a resolution repudiating all liability in the case of Wilkinson

v. C. J. de Villiers and others. The next development was a letter of demand sent to the council on behalf of Mr. C. J. de Villiers and his companions in misfortune. At the same meeting at which this letter of demand was laid before the council, a letter from several councillors was read, praying the Mayor to convene a public meeting of ratepayers and to lay the matter before them. This was agreed to, and the Mayor was also authorised to proceed to Cape Town and obtain counsel's opinion on the matter. He duly reported that counsel's opinon supported the present council in repudiating the claim. The public meeting of ratepayers was held, and, after considerable discussion, a motion was passed, by 102 votes to 27, repudiating all liability and refusing to pay the costs. It now remains to be seen whether another action will follow and whether the ex-Mayor and councillors concerned will sue the present council for recovery of the costs."

Reval Contract for British Firm.—The Finance Committee of the Reval Municipal Council has decided in favour of awarding the contract for a new city water supply system to the English firm of Paterson, Ltd., which submitted an estimate of 142,000,000 Esthonian marks. Another tender submitted by the Siemens Bauunion—a German firm—gave an estimate of 139,000,000 Esthonian marks.—*Reuter.*

The Wireless Retailers' Association.—As briefly announced in our last issue, a new association has been formed with this title (offices: 70, Finsbury Pavement, London, E.C.2). The objects of the Association are officially set forth as follows:—

1. To promote, develop, and safeguard the interests of retailers of wireless apparatus, parts, accessories, and components.
2. To maintain and extend by all possible means the markets in wireless, *e.g.*, by encouraging the broadcasting of entertainments, news, and other matters of the greatest interest to the widest public.
3. To investigate conditions, and, if found necessary, to take steps to secure satisfactory arrangements in the matter of trade discounts.
4. To advise members on matters arising in their businesses as retailers, such as questions of patents, licences, royalties, the conditions of reception existing in certain districts, &c.
5. To examine existing laws and regulations affecting the wireless industry and any further legislative or administrative proposals, with a view to securing adequate consideration for the interests of the retailer.
6. To take such steps and to make such representations to the Government or to such authorities or bodies as may appear expedient.
7. To acquire technical books and subscribe to trade periodicals for the reference of members, and to collect data and compile statistics, &c.
8. To disseminate to its members information on all general matters affecting retailers.

It is considered that "The wireless industry is, at the present time, more or less in its infancy, but its future possibilities are enormous and its progress will be rapid. It is therefore essential that the interests of all retailers should be strongly protected by an association consisting of themselves, which can represent them in dealing with the many and complicated problems which confront, and will continue to confront, the retail trade, and which can be met only by collective action."

The following are members of the Committee:—

F. A. Bagley (chairman), Messrs. J. & E. Ashley, 5, New Oxford Street, W.C.1.
F. S. Horsey, Messrs. E. G. Wood, 2, Queen Street, Cheapside, E.C.4.
H. C. Willard, managing director, Messrs. Heeps, Willard & Co., Ltd., 48, London Wall, E.C.2.
George H. Parker, 10, St. James's Parade, Muswell Hill, N.10.
W. E. Greville, managing director, Radio Stocks, Ltd., 89, Newman Street, Oxford Street, W.
H. H. Pugh, Messrs. Pugh Bros., 97, Holloway Road, N.7.
L. Willcocks, Messrs. L. Willcocks & Son, Camden Radio Depôt, 48, Camden Road, N.W.1.
H. Spencer Ellen, Spencer's Stores, 4-5, Mason's Avenue, Basinghall Street, E.C.
A. E. Betambeau, Messrs. A. E. Betambeau, 20-22, Anerley Station Road, Anerley, S.E.20.
R. Alexander, Messrs. Hughes & Alexander, 51, Honor Oak Park, S.E.23.

The British Empire Exhibition.—The St. Marylebone Electric Supply Committee has had under consideration a circular from the British Electrical Development Association asking for a contribution towards the cost of the electrical development exhibition which is planned. The Council's contribution, based on the annual revenue, would be about £600, and the Committee recommends that the proposal should not be entertained.

Price Reductions.—The Hart Accumulator Co., Ltd., announces a further reduction of 10 per cent. in the list prices of its motor-car starting and lighting batteries for home and export trade as from July 2nd.

The Falkirk Iron Company.—In the course of his remarks at the recent annual meeting of the company, the chairman (Mr. R. W. Kennard) said that they had been fortunate in concluding an amalgamation with the firm of Messrs. H. E. Hoole & Co., Ltd., of Sheffield, during the year. This firm was one of the oldest light castings foundries in this country, having been established in 1793.

LIGHTING AND POWER NOTES.

Bacup.—Electricity in Bulk.—The Town Council has been in negotiation with the Rawtenstall Corporation for a bulk supply of electricity, and the latter authority has offered a supply for power purposes at a charge of 1d. per kWh for the first 10,000 kWh per month, .95d. for the next 10,000 kWh, .9d. up to 50,000 kWh, .85d. for the next 50,000 kWh, and .8d. per kWh for all energy beyond this amount.

Banstead.—Special Order.—The Electricity Commissioners have granted a Special Order to Mr. Gilbert Allom, electrical engineer, which provides for the amalgamation of the undertakings authorised by the Banstead, Walton-on-the-Hill, and Kingswood Electric Lighting Order, 1914, and the Chipstead and District Electric Lighting Order, 1915, and to constitute them one undertaking. It also provides for the transfer of the amalgamated undertakings to the South Metropolitan Electric Tramways and Lighting Co., Ltd.

Barnstaple.—Loan.—The Town Council has applied to the Electricity Commissioners for sanction to the borrowing of £3,552 for mains, services, &c.

Barrow-in-Furness.—Year's Working.—The report of the borough electrical engineer (Mr. H. R. Burnett) for the year ended March 31st last states that the total income was £75,347, as compared with £77,122 in 1921-22. The working expenditure amounted to £40,851, as against £51,010, leaving a gross profit of £34,106 (£26,112). Capital charges remained at about the same level, and the net result was, therefore, an increase in profit from £374 to £8,146. A sum of £18,375 was spent on capital account during the year, principally on mains and services. The amount of energy sold rose from 6,886,504 to 7,434,102 kWh, in spite of the prevailing industrial slackness in the district.

Bolton.—Year's Working.—The total income accruing to the municipal electricity department (engineer: Mr. W. J. H. Wood) during the year ended March 31st last was £271,493, as compared with £269,237 in 1921-22. The working expenses fell from £166,166 to £130,449, leaving a gross profit of £141,494, as against £103,070. After crediting interest and debiting capital charges, a balance of £34,046 profit remained. The previous year's net profit was £18,670. The addition of £7,502 brought forward gave an available balance of £41,547, and of this amount revenue contributions to capital expenditure absorbed £21,144, the balance (£20,403) being carried forward. A total of £199,864 was spent on plant, &c., during the year, extensions of the Back-o'-th'-Bank works costing £156,454 and sub-station equipment £18,342. A total of 38,279,728 kWh was sold, as compared with 31,876,014 kWh in 1921-22. The total cost per kWh sold was 1.240d. (as against 1.527d.), and the average price obtained per kWh was 1.44d. (1.63d.). The maximum demand rose by over 2,300 kW to 17,870 kW.

Canada.—British Columbia.—*Hydro-Electric Scheme.*—The British Columbia Electric Railway Co. contemplates the further development of water power resources involving an expenditure of $10,000,000 and raising the total turbine capacity from 52,000 to 268,000 h.p.—*Reuter's Trade Service* (Vancouver).

Chester.—Loan Sanctioned.—The Town Council has received the sanction of the Electricity Commissioners to the borrowing of £3,000 for mains, in connection with the supply in the Hoole and Newton districts.

China.—Tientsin.—*Year's Working.*—The report of the Electricity Department of the British Municipal Council, Tientsin (engineer: Mr. R. A. Williams, M.C.), states that the new station was practically completed in October last, and the plant was working on full load. The load factor improved from 19.5 to 23.6 per cent., and the total sale of energy amounted to 1,727,422 kWh, as against 1,190,286 kWh in 1921. During the year the lighting connections increased by 374 kW, and power connections (including heating, &c.) by 335 kW. The accounts show a revenue of taels 224,317 and an expenditure (inclusive of capital charges) of taels 166,781, leaving a surplus of taels 57,536. The capital expenditure amounted to about taels 237,000, practically the whole of the money being expended on generating plant.

Colchester.—Year's Working. — *Correction.* — We regret that in the note under this heading in our last issue we reversed the figures of the sales of energy by the undertaking during 1921-22 and 1922-23. The statement should have read: "There was an *increase* in the sales of energy from 1,485,472 to 1,585,747."

Continental.—Russia.—A new turbo-generator of 1,700 kW capacity has recently been installed at the generating station of the Société de l'Electricité de Bialystock at Bialystock.

Croydon.—Year's Working.—The report of the borough electrical engineer (Mr. A. C. Cramb) upon the working of the electricity undertaking during the year ended March 31st last shows that the income amounted to £174,266 and the working expenses to £98,749. In the previous year these figures were £174,697 and £107,339 respectively. The gross profit was thus £75,517, as compared with £67,358 in the previous year. After charging capital services against this amount, a net profit of £36,371 remained—an increase of over

£10,000 above the previous year's surplus. The whole of this profit was transferred to reserve. The capital expenditure during the year amounted to about £47,000, the chief items being £12,128 for boiler plant and £19,143 for mains and transformers. The capital expended reached a total of £669,379, of which £332,220—about half—has been repaid or is represented by the sinking fund balance.

The sales of energy rose from 10,761,817 to 12,592,515 kWh, there being an increase in the supply of electricity for power purposes and a quantity of about one million kWh supplied under the new "all-in" rate; the latter accounted for a decrease in private consumption under ordinary heads. The maximum demand rose by 800 kW to 7,100 kW. The works cost per kWh sold fell from 2.05d. to 1.35d., while the overall cost dropped from 3.30d. to 2.62d., and the revenue from 3.88d. to 3.31d. The report states that it has been decided to revert gradually from d.c. to a.c. in the central district. It is also pointed out that on several occasions the maximum demand has occurred in the morning, indicating the growth of the domestic load.

Dundee.—Loan Sanctioned.—The Town Council has received the sanction of the Electricity Commissioners to the borrowing of £50,000 for electricity purposes.

Electricity Districts.—Mid-Lancashire Draft Order and Inquiry.—The Electricity Commissioners have issued a draft Order constituting the Mid Lancashire Electricity District and establishing the Advisory Board, and give notice that a local inquiry will be held at the Town Hall, Preston, on Tuesday, July 31st, at 10.30 a.m., with reference to the scheme and finally to determine the area. Representations with regard to the provisions of the scheme should be submitted to the Commissioners not later than Monday, July 23rd. The technical scheme provisionally adopted was outlined in the Electrical Review of May 25th, p. 810.

Mersey and West Lancashire.—Following the inquiry held by the Electricity Commissioners at Liverpool, the Liverpool City Council appointed a special committee to consider the draft Mersey and West Lancashire Electricity District Order. The Committee has now issued the following report: "The Special Committee, having fully considered the draft Mersey and West Lancashire Electricity District Order, 1923, and the reports thereon of the town clerk, the city treasurer and controller, and the city electrical engineer, is unable, in view of the altered circumstances since the original scheme was formulated, to recommend the Council to support the scheme embodied in the draft Order, and recommends the Council to withdraw from the same."

Electricity Orders.—Confirmation.—The Ministry of Transport has confirmed Special Electricity Orders made by the Electricity Commissioners in respect of the following districts:—Mold (Flintshire); Welwyn Garden City; Street (amendment); and Cardiff Rural District (extension).

Ellesmere Port.—Electricity Supply.—The Mersey Power Co., which has acquired the rights of electricity supply for the district, has commenced work on the laying of mains, and it is anticipated that a supply will be available by the end of July.

Hastings.—New Power Station.—The Corporation has adopted a scheme for a new power station at Broomgrove, near Ore Station, at an estimated cost of £130,000. The capacity of the new plant will be 14,500 kW. It is anticipated that it will be completed by the winter of 1924.

Kirkcaldy.—Year's Working.—The revenue account of the burgh electricity undertaking (engineer: Mr. O. F. Francis) for the year ended May 15th last shows that the total income was £39,400, as compared with £42,868 in the preceding year. Working expenses amounted to £21,094, as against £28,012, leaving a gross surplus of £18,306 (£14,856). Capital charges were slightly higher, but the result was an increase in the net profit from £7,623 to £10,481. During the year £25,625 was expended on capital account, the principal item being £17,302 for buildings. The energy sold increased to a small extent—from 3,526,587 to 3,863,987 kWh. The total cost per kWh sold fell from 1.882d. to 1.296d.

Llanelly.—Low Generating Costs.—According to the Electricity Commissioners' returns, showing the efficiency of generation in British power stations during 1922, the lowest fuel consumption per kWh generated in the South Wales area was attained by the Llanelly and District Electric Lighting and Traction Co., Ltd., with a figure of 2.62 lb. per kWh. Mr. J. E. Stewart, M.I.E.E., was manager of the undertaking until the end of 1922.

London.—St. Marylebone.—The Electric Supply Committee reports that a mishap occurred to an 8,000-kW Oerlikon turbo-alternator on June 2nd, due to a short section of the shrouding on the eighth wheel of the turbine rotor breaking away and causing damage to the blades of the ninth and tenth wheels and some of the tubes in the condenser below. The rotor has been despatched to the maker's works for the completion of the necessary repairs, which will be undertaken free of cost to the Council under the maintenance agreement. There was no interruption of supply due to this failure.

Long Eaton.—Year's Working.—The report on the working of the electricity undertaking for the past year (engineer: Mr. F. Newey) shows a net profit of £2,500.

Maidstone.—Loan Sanctioned.—The Town Council has received sanction to a loan of £2,139 for a motor-converter for the electricity works. It is proposed to extend the electricity supply to Loose at a cost of £5,452, and application is to be made to the Electricity Commissioners for authority to supply electricity outside the borough.

Manchester.—Barton Power Station.—The first of three generators which are being installed at the Barton power station was started up on June 27th. It is proposed to formally open the station in October, when the second set will be in operation.

Palestine.—The Rutenberg Concession.—According to *The Times*, the Government applied the necessary tests at the Rutenberg power station for the fulfilment of the terms of concession on June 29th with satisfactory results. Work in connection with the harnessing of the River Auja, near Jaffa, will commence in August, the Arab landowners now being amenable.

Preesall (Lancs.).—Electricity in Bulk.—The Urban District Council proposes to obtain an electricity supply for the district, and has applied to the Blackpool Corporation for terms upon which it would be willing to give a supply in bulk.

Price Reductions.—Reductions in the charges for electricity have been made in the following districts:—

Milnrow.—Heating and domestic power: First 50 kWh per quarter, 2½d. per kWh; next 50 kWh, 2d. per kWh; next 200 kWh, 1½d.; above this amount, 1½d. per kWh. Industrial power: First 500 kWh per quarter, 3d. per kWh; next 1,000 kWh, 2d. per kWh; next 1,500, 1½d. per kWh; next 10,000, 1¼d. per kWh; next 10,000, 1d.; all energy in excess of this amount .9d. per kWh.

Hoylake and West Kirby.—Power: First 500 kWh, from 3½d. to 3d. per kWh. For all energy above this amount, from 3d. to 2½d. per kWh.

Edinburgh.—Lighting: From 4½d. to 4d. per kWh. Cooking and heating: from 1½d. to 1d. per kWh.

Bridlington.—A reduction of 1d. per kWh for lighting.

Oban.—Lighting: From 11d. to 9d. per kWh. Heating and cooking: From 3d. to 2½d. per kWh. Power: From 6½d. to 5½d. per kWh.

Retford.—Special Order.—The Town Council has applied to the Electricity Commissioners for a Special Order authorising it to supply electricity in the borough and in the rural district of East Retford.

Salford.—Loan.—The Town Council is applying to the Electricity Commissioners for sanction to the borrowing of £2,150 for mains.

South Africa.—Johannesburg.—The Municipal Council has approved a scheme for the construction of a new power station, involving an expenditure of £550,000.—*Reuter's Trade Service* (Johannesburg).

South Molton.—Special Order.—The Corporation has applied to the Electricity Commissioners for a Special Order authorising it to supply electricity in the borough.

Stoke-on-Trent.—Year's Working.—There was a gross profit of £71,765 on the electricity undertaking (engineer: Mr. C. H. Yeaman) for the past year. After providing for interest and sinking fund and £3,404 for meters, there remains a net profit of £8,770, which has been transferred to the reserve fund.

Sunderland.—Year's Working.—The report on the Corporation electricity undertaking (engineer: Mr. A. S. Blackman) for the year ended March 31st last shows an increased output over last year—15,318,982 kWh as compared with 14,430,851. The sales are still 27½ per cent. below the sales for 1921, this loss being due to the depressed state of industry and the decreased demand for power supplies. The cost of production was 1.85d. per kWh. The accounts show a total income of £129,389 and expenditure amounting to £69,305. Of the balance of £60,084, £17,254 is required for interest on capital and £3,457 for income tax. The balance of £38,923 carried to the appropriation account is allotted as follows: Repayment of loans, £27,634; depreciation of stock, £599; depreciation and renewals fund, £4,782; and £5,906 handed back to the District Fund in repayment of loan. The capital account of the undertaking stands at £755,153, of which £344,199 remains as outstanding loans. The depreciation and renewals fund amounts to £11,665.

West Ham.—Year's Working.—The report of the engineer and manager of the electricity undertaking (Mr. F. W. Purse) for the year ended March 31st last records a total revenue of £357,369, a decrease of £51,873; the working expenses decreased by £74,714 to £244,710. The gross surplus was thus £112,659, as compared with £89,818 in the previous year. Interest and loan repayment charges increased, but the net result was a profit of £40,776, an increase of £17,304. There was an increase in the amount of energy sold from 40,505,500 to 45,162,034 kWh, this increase being distributed over all items. The plant capacity rose during the year from 17,900 to 27,900 kW by the installation of the new 10,000-kW set described by us a year ago. The maximum demand was 17,080 kW, as against 13,865 kW in the previous year. The capital expenditure during the year amounted to £72,126, the largest single item being £28,648 for machinery and plant.

The report states that a second 10,000-kW set is nearing completion, which will provide a margin of safety, which has been needed for many years. During the winter, as an unemployment relief measure, considerable mains extensions were made, nearly 20 miles of streets being cabled. The charges have already been reduced on two occasions, but the engineer anticipates that it will be possible to lower them further during the current year. Special reference is made to the success of the Sales Department.

Willesden.—NEW TARIFFS.—As from the commencement of the Michaelmas quarter a new scale of charges is to be put into force. Consumers are being given a choice of alternative tariffs and a new "combined" rate is being adopted for domestic lighting, cooking, &c. To the average number of kWh used for lighting during the previous three years by any one consumer 10 per cent. will be added, and that number will be charged as a minimum yearly payment in the following manner: One-third for each of the winter quarters, and one-sixth for each of the summer quarters, at the rate of 4½d. per kWh, and all energy in excess of the amount so charged will be supplied at the rate of 1½d. per kWh. The two charges mentioned are the lighting and domestic heating flat rates, and it will be seen that the new arrangement obviates double wiring.

Wimbledon.—YEAR'S WORKING.—The accounts of the borough electricity undertaking (engineer: Mr. A. E. McKenzie) for the year ended March 31st last record a total income of £99,965, as compared with £87,359 in the previous year. Against this was charged a working expenditure of £47,239, as compared with £59,200, leaving a gross surplus of £52,726 (£28,159). The capital charges showed an increase, but the final result was a profit of £28,702, as against £5,894 in 1921-22. A total of £26,698 was spent on capital account during the year; this included £12,445 for mains and services and £5,857 for transformers, motors, &c. The total sales of energy rose from 4,277,808 to 6,156,683 kWh. The overall cost per kWh sold was reduced from 4.590d. to 2.776d., and the price obtained from 4.724d. to 3.574d.

TRAMWAY AND RAILWAY NOTES.

Kirkcaldy.—YEAR'S WORKING.—During the year ended May 15th last the municipal tramways earned a total of £36,759, as compared with £36,779 in 1921-22. Against this was charged a working expenditure of £29,154, as compared with £32,450, leaving a surplus of £7,605 (£4,349). This was sufficient to meet capital charges, a balance of £227 remaining. in the previous year a loss of £2,527 was incurred. The car-mileage remained at about the same figure, being 428,390, as against 424,727, but the number of passengers carried fell from 4,747,799 to 4,604,908.

London.—RECONSTRUCTION OF TOTTENHAM COURT ROAD STATIONS.—The Underground Electric Railways Co. has placed contracts with Messrs. J. Mowlem & Co., and Messrs. Waygood-Otis, Ltd., for the reconstruction of the Central London and Hampstead Stations at Tottenham Court Road. The Hampstead line booking hall is to be enlarged and will serve as a combined booking hall for both lines. Escalators are to be constructed. The total cost of the scheme is £125,000.

TUBE STRIKE.—The result of the ballot for or against resuming work by the men employed on the reconstruction of the City and South London Railway, which was announced on July 2nd, showed a majority for resumption of work of 16. It was stated on behalf of the committee that the majority was not sufficient to justify the men's returning to work, as it was contended that a two-thirds majority was necessary.

SEASON TICKETS.—The combined train, omnibus and tram season tickets which were introduced on the Underground Railway at Golders Green and Hammersmith having proved successful, it has been decided to introduce the scheme at Ealing Broadway and Boston Manor stations.. This will enable passengers to travel by 'bus or tram to either of these stations and to continue the journey by the "Underground."

Northampton.—YEAR'S WORKING.—The report upon the working of the municipal tramway undertaking (manager: Mr. J. F. Cameron) for the year ended March 31st last, records a total revenue of £75,630, and working expenses amounting to £54,808. In the previous year the equivalent figures were £72,519 and £56,342. The gross profit was thus £20,822, as compared with £16,177. The capital charges were lower, increasing the net profit from £5,792 to £11,039. Of this amount £3,250 was transferred to reserve; £1,000 was used for capital purposes, £3,492 was contributed to the relief of the rates, and the balance of £3,297 was carried forward. The car mileage increased from 749,268 to 818,185 and the number of passengers from 10,534,713 to 11,266,592. The percentage ratio of expenses to receipts fell from 78 to 73.

Sunderland.—YEAR'S WORKING.—The annual report of the Corporation tramway undertaking for the year ended March 31st last shows traffic receipts of £130,706, which are over £7,000 less than in 1922 and over £27,000 less than in 1921. The passengers carried numbered 25,996,436, or nearly 2¼ millions fewer than in 1922 and 6½ millions fewer than in 1921. The average receipts per car-mile were 20.2d. The total income was £132,868, as compared with £138,820 in the previous year. Working expenses amounted to £102,016 (£118,156) leaving a gross profit of £30,960 (£20,664). After paying interest on capital (£4,143), bank interest (£832), and income tax (£3,467) the balance of £22,517 was allotted as follows: Repayment of loans, £7,593; renewals of cars and trucks, £6,507; new cars and trucks, £1,442; renewals fund, £4,716; Sea Lane siding, £1,391; and two smaller items for road improvements. The amount in reserve and renewals funds at March 31st was £18,765. In the previous year there was a profit of £311. Out of a capital expenditure of £336,346 only £75,867 remains as outstanding loans.

NEW ROUTES.—The Tramways Committee has recommended that the system be extended *via* Durham Road to Silksworth, a distance of 2½ miles, to link up with the Sunderland District Electric Tramways, Ltd.'s, system, and also from Sea Lane to Whitburn.

TELEGRAPH & TELEPHONE NOTES.

The Telephone Service.—SOUTHAMPTON'S AUTOMATIC EXCHANGE.—An automatic telephone exchange, equipped by Messrs. Siemens Bros. & Co., Ltd., was opened at Southampton on June 30th, when the existing manual exchange was taken out of service.

REDUCTIONS IN CHARGES.—The Postmaster-General announces that the reductions in telephone charges to which reference was made in the Budget statement in the House of Commons in April took effect from Sunday last, July 1st.

RADIO-TELEGRAPHY AND TELEPHONY.

Amateurs' Aerials.—*The Times* says that the Urban District Council's Association has instructed its Executive Council to consider from the point of view of supervision by local authorities the safety of aerials erected by amateurs. It is stated that many badly-erected aerials are in existence which possess elements of danger to the public. The British Broadcasting Co. states that the question is not one for it to deal with, and Mr. Leslie McMichael, secretary of the Radio Society of Great Britain, says that it is not the business of the local authorities, but the owners of the property upon which aerials are erected.

An Atmospherics-Eliminating Device.—M. Yves Marrec, a French engineer, has devised what is claimed to be one of the most important developments in radio-telegraphy, and likely to have a far-reaching effect in the near future. This is an invention designed to eliminate atmospherics and all parasitic noises when receiving radio-telegraphy. The invention consists of certain circuits controlled and grouped behind an ordinary receiver and forming a supplementary apparatus. A test set has been set up in a room at Holborn Viaduct, where there are many disturbing influences, and, using an indoor aerial, messages have been picked up from New York and Washington during the most congested periods of the day. The "purified" message was received so loudly that it could be heard and written down at a distance of several yards from the telephones, and so strongly that by passing it through a relay the American message was printed on the tape of a Morse inking machine. It is claimed that the Marrec receiver has entirely done away with the trouble usually experienced, owing to atmospherics and other disturbances, when mechanical printers are employed. It also obviates the necessity of closing down important long-distance transmitting stations during the congested hours of the day. The invention is based upon a combination of the amplified low-frequency currents with other continuous oscillations of a different audio-frequency. The currents thus obtained are applied to amplifying values having circuits selectively tuned to the original frequency.

Radio Broadcasting.—THE BIRMINGHAM STATION.—The Birmingham broadcasting station was listened to recently under conditions which were somewhat remarkable and illustrate in an interesting way the possibilities of radio-telephony in the open air. With a portable valve set in his car a motorist entertained a party of Boy Scouts who were encamped on a large clearing in the heart of a wood. The aerial was a single length of wire slung from a tree and the "earth" connection was made by fastening a wire to a tin-can, which was thrown into an adjacent brook. The filaments of the valves were lit from the car batteries.

Regardless of the very haphazard character of these arrangements, 5IT, approximately 50 miles away, was heard so loudly that the concert could be listened to well over a hundred yards away. This success was especially gratifying in view of the fact that the presence of many trees near an aerial is said to have a screening effect.

Premises for the new studio for the Birmingham broadcasting station have been secured, and the change-over will be made on August 7th. The premises are in New Street, in the centre of the city. New transmitting plant is being erected at the Summer Lane power station and a cable will be laid between the station and the studio, a distance of approximately a mile.

THE HYDRO-ELECTRIC SUPPLY TO COLWYN BAY.

By T. VAUGHAN HUGHES, A.R.S.M., F.I.C.

The formal inauguration of the distributing station in Ivy Street, Colwyn Bay, owned and operated by the Colwyn Bay Urban District Council, took place on November 30th last. Special interest attaches to this undertaking, because the scheme is the first hydro-electric public supply sanctioned by the Electricity Commissioners under the Acts of 1919 and 1922, and the resident electrical engineer is also the managing engineer of the Council's gas undertaking, an unusual combination of functions. Power is transmitted at about 20,000 V (shortly to be raised to 34,600 V) from the Cwm Dyli hydro-electric station, situate at the foot of Snowdon, and also from Dolgarrog, in the Vale of Conway. These works are operated by the North Wales Power Co., Ltd., the current being delivered through about 34 miles of overhead transmission lines, *via* Dolgarrog, to the Bron-y-nant static transformer sub-station situate on the western confines of the Colwyn Bay U.D.C. area of supply. There the pressure is transformed down to 6,600 V, and the current is led through about 2,500 yd. of cable, laid in duplicate, to the motor-converter station in Ivy Street, situate at about the centre of the district of Colwyn Bay.

Fig. 1.—The New Dam.

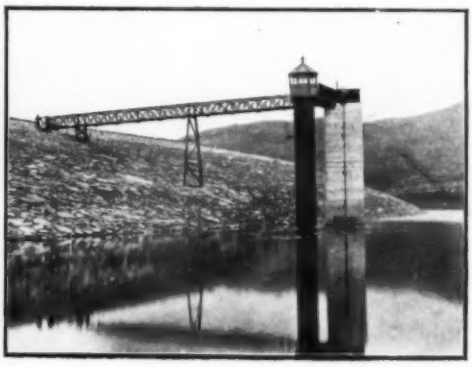

Fig. 2.—Cowlyd Lake and Stand-pipe.

The Cwm Dyli power house was erected in 1903-1904, and was designed to supply the slate quarries with electric power, generated and transmitted at 10,000 V, 3-phase, 50 cycles. The plant makes use of the water in Lake Llydaw, 1,420 ft. above O.D., which lake receives the overflow of a smaller and adjacent lake, Llyn Gaslyn. The average annual rainfall, taken over 10 years in the catchment area of these lakes, is 150 in.

The lake, being contained in a dormant volcanic vent, is surrounded by the usual saucer-like rim of rock; this has been pierced by a tunnel 6 ft. in diameter, the outlet of which is 30 ft. below the level of the lake. The inflow to this tunnel is controlled by two 48-in. sluice valves. At the terminal of the tunnel the water is delivered into two pipe lines, laid side by side, 30 in. in diameter, contracted to 27 in. in the section

Fig. 3.—Cwm Dyli Power Station: Interior of Turbine Room.

leading into the power house. The pipe line is 1¼ miles long. It is considered possible to increase the capacity of the lake from 150 million cu. ft. to about 250 million cu. ft. by raising the dam.

The generating plant in the power house (about

FIG. 4.—CWM DYLI: BRUCE PEEBLES 1,500-kW TURBO-GENERATOR.

265 ft. above O.D.) consists of four twin Pelton wheels, each coupled directly to a 1,000-kW, 12-pole alternator, with its own exciter, and one alternator rated at 1,500 kW. The five machines were supplied by Messrs. Bruce Peebles & Co., Ltd.; four generate at 10,000 V and one

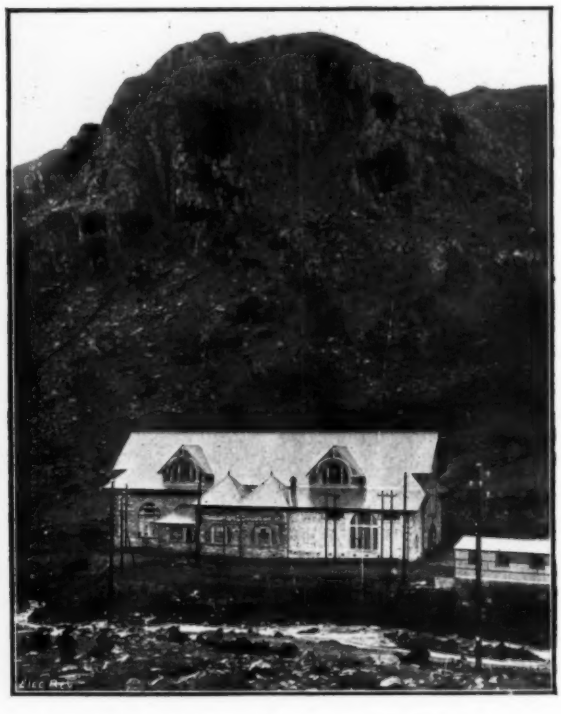

FIG. 5.—CWM DYLI POWER STATION.

at 4,800 V. The Pelton wheels have been overhauled by Messrs. Boving & Co.; they run at 500 r.p.m. The new governors are of the oil-pressure type, supplied by the last-named firm. The present capacity of the plant is 5,500 kW. Step-up transformers by Messrs. Ferranti, Ltd., raise the voltage either to 20,000 or 34,600 V for transmission. At the terminals of the older transmission lines transformers reduce the voltage to 550/500 V a.c. for use in the quarries.

For the overhead transmission line, creosoted wooden poles, about 38 ft. long, erected A-wise and strutted or stayed as required, are used on straight runs and moderately-windswept routes. Along exposed positions and over road crossings substantial H poles are substituted. The normal spacing is 30 or 35 to the mile. Galvanised-iron angle or channel-section cross arms are fixed to the poles. Standard 35,000-V porcelain insulators, partly of British and partly of American make, are used to support the line conductors. The cross arms are all earthed by connecting them through a galvanised-iron wire to a continuous earth wire, which is earthed through a copper wire to a buried earth plate at every fifth pole. The above type of transmission line serves the slate quarries, the Marconi radio station, the granite quarries at Penmaenmawr, and the Dolgarrog power house.

As the line connecting Dolgarrog and Colwyn Bay crosses the River Conway and a few gullies, lattice

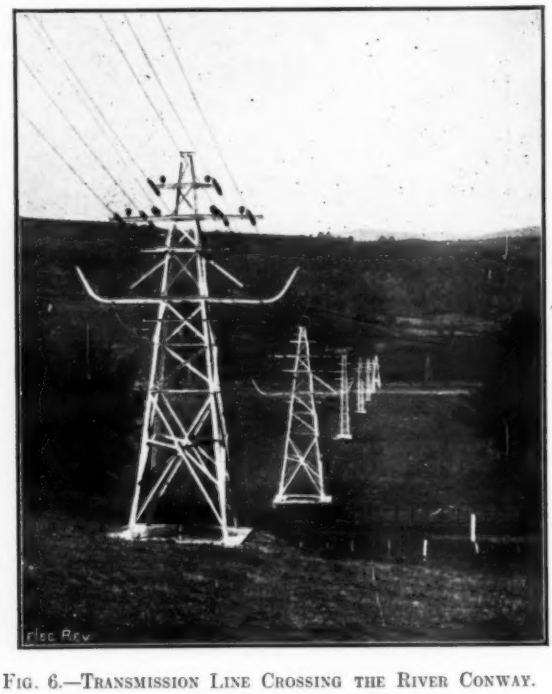

FIG. 6.—TRANSMISSION LINE CROSSING THE RIVER CONWAY.

girder masts fixed on concrete footings replace the wooden poles at these points.

The Dolgarrog power station, situate on the River Conway, about 22 miles from Cwm Dyli, operates the extensive works of the Aluminium Corporation, Ltd.,

in addition to the electricity supplies indicated above. Water for actuating the prime movers in this power house is at present obtained from Llyn Eigenau, situate in a watershed adjoining that of Llyn Cowlyd. Surplus waters from the Dulyn and Melynllyn watersheds supplement Llyn Eigenau. From the lakes in this region the supply of potable water to Llandudno is obtained.

The surplus waters from the Dulyn and Melynllyn lakes are conveyed through a tunnel penetrating the mountain separating the two valleys. The water from Llyn Eigenau runs down the natural stream course for about two miles, and is then, by means of a catchwater, conveyed to a concentration reservoir of 1,050 ft. above O.D. and immediately above the Aluminium Corporation's works. From the forebay the water is conveyed through a 36-in. steel pipe line to the power house in the Dolgarrog works, which is 24 ft. above O.D. on the bank of the Conway River. Thus, a head of about 1,020 ft. is available. The average rainfall in the Dolgarrog area is 83 in. per annum, taken over a period of ten years.

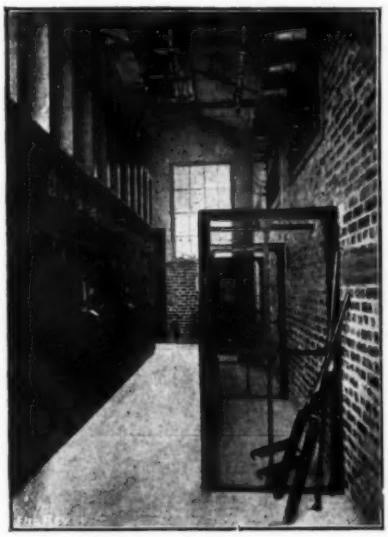

Fig. 7.—Steel Cubicles on Top Floor.

Fig. 8.—6,600-V Switchboard on Ground Floor. Bron-y-nant Sub-station: Ferguson, Pailin Switchgear.

those at Cwm Dyli, controlled by oil-pressure governors and coupled directly to 1,200-kW, 1,100-V, 50-cycle, 3-phase alternators supplied by Messrs. Bruce Peebles and Co. The high-pressure switching arrangements here permit of the transmission lines from Cwm Dyli being directly connected to the transmission lines to the Colwyn Bay transformer sub-station, and of switching-in the high-pressure current generated by the alternators at Dolgarrog as and when required.

The metallurgical processes of the Aluminium Corporation are operated by low-pressure d.c. generators, coupled to Pelton wheels, supplemented by two 600-kW motor-generators for converting a.c. at 1,100 V to d.c. at 75 V and 125 V.

The programme of further developments under the Order of the Electricity Commissioners includes the

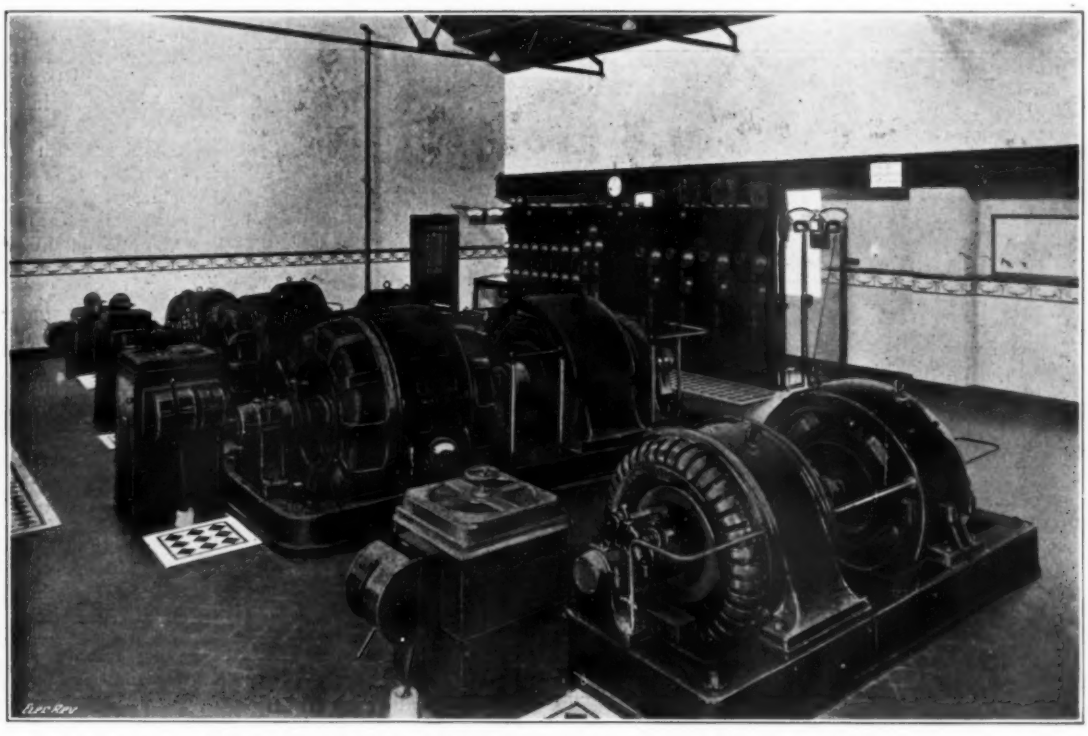

Fig. 9.—Bruce Peebles Motor-Converters in Ivy Street Sub-station.

A description of the dam erected to increase the capacity of the Cowlyd lake appeared in the Electrical Review of September 29th, 1922; the total capacity of the new lake is estimated at 3,110 million gallons.

The plant at present installed in the Dolgarrog power house consists of two twin Pelton wheels similar to

harnessing of the water power at Maentwrog, in the Vale of Festiniog, to the south and west of Snowdon. Here the average rainfall is about 93 in. per annum. The first instalment of generating plant in this watershed must be of not less than 12,000-kW capacity. This station will be coupled by duplicate transmission lines to Cwm Dyli and as otherwise specified by the Commissioners. Thus, the district under the Order will be served by water-power stations in triplicate.

The Bron-y-nant step-down transformer house is a two-storeyed brick building erected at the extreme western boundary of the Colwyn Bay urban district. The top floor, of reinforced concrete, resting on steel joists, is reserved for the steel cubicles protecting the 20,000-V or 34,600-V switchgear and adjuncts. The lower floor, of plain concrete, is raised 4 ft. above the roadway and is divided longitudinally, by a brick wall, into two compartments. The front compartment contains the oil-immersed self-cooled transformers, supplied by Messrs. Ferranti, Ltd.; provision is made for three, and two, of 1,000-kVA capacity, with transforming ratios of 34,600/6,600, 20,000/6,600, are already installed.

Access to the top floor is provided by an outside c.i. stairway, and to the bottom floor by a doorway below the stairway. There is no internal means of access from one floor to the other. The back compartment forms the 6,600-V switchboard room. The transformer compartment is closed by three wooden sliding doors. The transformers can be wheeled from the deck of a lorry into position, without the help of hoisting tackle.

Fig. 10.—Reyrolle 6,600-V Armourclad Switchgear.

The incoming transmission lines are brought to six sets of terminal shackles, each formed of four insulators bolted to one another in tandem. The terminal strain is taken by a steel channel girder secured to the wall of the building by bolts and anchor plates. The bare line wires, each of 0.1 sq. in. section, are led into the building through Thomas tubes, fixed not less than 8 in. apart, in a cement panel, which is inserted in the wall of the building about 8 ft. below the roof wall plate. Inside the upper room the line wires are solid, and are carried on white porcelain pillar insulators.

The 34,600-V and the 6,600-V switchgear, figs. 7 & 8, was supplied by Messrs. Ferguson, Pailin, Ltd.

Two 0.1-in., 3-core, paper-insulated, lead-covered, and steel-tape-armoured cables connect the sub-station

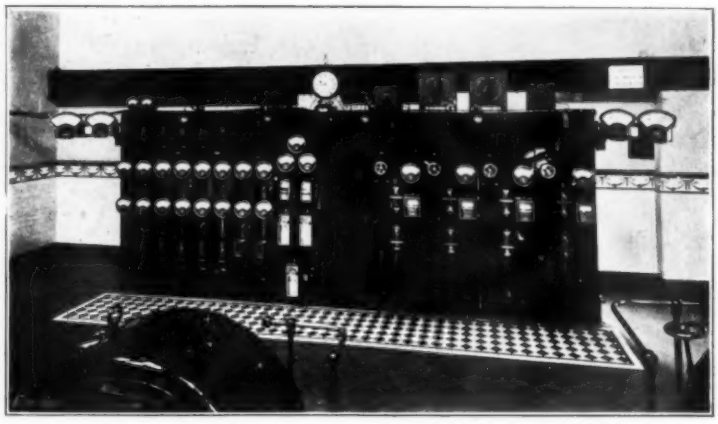

Fig. 11.—Bertram Thomas Low-Pressure Switchboard.

and Ivy Street. They were supplied and laid by Messrs. W. T. Glover & Co., Ltd. The Ivy Street motor-converter and distributing station is built of brick, with steel roof principals, and is designed to accommodate four motor-converters of 500-kVA output each, making a total of 2,000 kVA.

The motor-converting plant was supplied and erected by Messrs. Bruce Peebles & Co., Ltd. The machines installed at present are two of 125 kW, one of 300 kW, and one of 500 kW, all running at 750 r.p.m. The 125-kW sets are each connected to an oil-immersed transformer made by the Foster Engineering Co., Ltd., transforming from 6,600 to 2,950 V. The stators of the other two machines are wound for 6,600 V. Direct current is generated at 440 V for lighting and power and at 550 V for traction.

The high-pressure switchgear, fig. 10, is of Messrs. Reyrolle and Co.'s armour-clad, draw-out type, in two parts, interconnected by a bus-bar section.

The cable connections and the low-pressure switchboard (fig. 11) were supplied by Messrs. Bertram Thomas.

The central area of the urban district is served at present with a 3-wire distributing system at 440 V between outers. The extensions of the distributing area in the eastern districts will be, and in the western districts are supplied with alternating current through step-down transformers (6,600/440 V), and it is proposed to enclose the whole area with a ring of 6,600-V feeders. An application has been made to the Electricity Commissioners to authorise supply with alternating current only.

Despite the special terms obtained from the North Wales Power Co. for energy at 6,600 V in the outlying sub-station, the cost of transmission to, and conversion losses at, the Ivy Street distributing station (2d. per unit), plus interest charges on outlays incurred on the old and present stations (4d. per unit), plus distribution and establishment costs (2d. per unit), render it economically impossible to reduce the present charge of 8d. per kWh to the consumer until the demand for electricity is double the present output. The output of the local electricity undertaking for the year 1922-3 was 700,321 kWh converted to d.c., the increase in units sold being 118,934.

Thanks are due to Mr. G. K. Paton, M.I.E.E., the consulting engineer, and to Mr. J. Smith, the resident engineer, for information, some illustrations, and assistance in the preparation of this article.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the ELECTRICAL REVIEW *in which the "Official Notice" appeared in our advertisement pages.)*

OPEN.

Australia.—SYDNEY (N.S.W.).—September 24th. City Council. 1,775 d.c. meters (5 to 150 amps.) and 36,200 single-phase meters (5 to 50 amps.).

November 19th. Storage batteries, regulating switches, copper connections, charging boosters, and switchgear.*

August 8th. Government Railways and Tramways, Chief of the Electrical Engineering Department. Six water-tube boilers, with electrically-driven mechanical stokers, forced-draught fans, &c., for the White Bay power house.*

MELBOURNE.—October 6th. Victorian Electricity Commission. 2,000 disk tensioning insulators and 6,000 pin-type supporting insulators for 22,000-V circuits.

August 8th. Victorian Government Railways. Three-phase a.c. induction motors, starting apparatus and accessories.*

August 25th. Transformers. (June 22nd.)

CAIRNS (QUEENSLAND).—July 21st. Municipal Council. Electrical generating plant and equipment. Particulars from Messrs. Christie & Gardiner, engineers, Brisbane, Queensland.

Belgium.—July 13th. Governor of the Province of Limbourg at Hasselt. 100 potential transformers, 100 current transformers, and 50 electricity meters. Particulars from the Service Provincial d'Electricité, 27, Avenue Bamps, Hasselt.

July 18th. Belgian Telegraph and Telephone authorities at La Salle Madeleine, Brussels. Supply and installation of two electric lifts at Malines.

Blackpool.—July 16th. Education Committee. Installation of electric lighting at Devonshire Road schools. Secretary, Education Committee. (June 29th.)

Bolton.—July 9th. Board of Guardians. Electric lighting installation at Townley's Hospital. Mr. J. Ward, architect to the Board of Guardians, 24, Mawdsley Street, Bolton.

Canary Islands.—The authorities of the Canary Islands at Santa Cruz de Tenerife have just invited tenders for the establishment of a system of telephonic communication with a number of exchanges throughout the Island of Tenerife.

Cardiff.—July 16th. Electricity Department. Brick setting for two water-tube boilers and economisers, and wet air filter. (June 22nd.)

Cromarty.—July 13th. Removal of electric lighting plant from Newton Camp to Cromarty, for the Town Council. Mr. P. Hay, estate office.

Edinburgh.—July 9th. Electricity Supply Department. House-service fuse boxes for three months. (June 29th.)

One 1,000-kVA, 3-phase to 2-phase Scott-connected transformer. (June 29th.)

Pavement box frames and covers and fire-clay pipes for three months. Engineer and manager's office, Dewar Place.

Exeter.—Committee of Management, Wonford House Hospital. Electric lighting installation at Wonford House. (See this issue.)

Halifax.—July 9th. Electric lighting installation at the following schools:—Pellon Lane Council school, Booth Town Council school, St. Augustine's Voluntary school. Mr. A. C. Tipple, borough engineer, Crossley Street, Halifax.

Hoyland Common (Yorks.).—July 17th. Electric lighting installation, Working Men's Club. H. Dickinson, secretary.

London.—LONDON COUNTY COUNCIL.—July 16th. 200 sets of tramcar motors with accessories. (June 29th.)

ST. PANCRAS.—July 19th. Electricity Department. L.p. d.c. switchboard. (See this issue.)

ILFORD.—July 16th. Education Committee. Electric lighting installation at the Christchurch Road cookery centre and Newbury Park handicraft centre. Mr. A. H. Shaw, electrical engineer.

Manchester.—July 10th. Tramways Committee. Permanent-way special track work. Mr. H. Mattinson, general manager, Corporation Tramways, 55, Piccadilly, Manchester.

New Zealand.—WELLINGTON.—July 31st. Public Works Tender Board. Electrical equipment for dredge No. 2 at Auckland.*

February 28th, 1924. Contract for Section I, headworks, &c., Arapuni hydro-electric power scheme.*

DUNEDIN.—July 30th. City Corporation. Switch cubicles.*

Pentre, Rhondda.—July 23rd. Rhondda Urban District Council. Three 150-kVA 3-phase static transformers. (See this issue.)

Salford.—Electric lighting installation at Assembly Room, Town Hall. Borough engineer, Town Hall.

Southport.—July 19th. Relaying with new rails tramway routes in Mornington Road, Derby Road, and Sussex Road (about 1,738 yd. reduced to single track). Specifications, &c., from borough engineer, Town Hall.

South Africa.—JOHANNESBURG.—July 17th. Municipal Council. Four d.c. recording ammeters and one totally-enclosed water-jacketed air compressor.*

DURBAN.—August 31st. Municipal Council. Plant in connection with the water scheme at Shongwani (including oil or gas engines, generators, cable ways, electric cranes, motors, &c.). Particulars from Messrs. Webster, Steel & Co., 5, East India Avenue, E.C.3.

Uruguay.—MONTEVIDEO.—August 7th. Outdoor cable, with special insulation.*

State Electricity Works. August 16th. Electrical accessories. Eight overhead transporters.*

Wigan.—August 9th. Board of Guardians. Electrical vertical pumping plant, &c. (See this issue.)

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

CLOSED.

Chester.—Electricity Committee. Accepted:—

Supply and erection of transmission lines (£3,522).—Callender's Cable and Construction Co., Ltd.

Dearne District Light Railways.

Sub-contractors for the overhead equipment and underground feeder cables, covering a route length of 13 miles.—Clough, Smith & Co., Ltd.

Dublin.—Corporation. Motor-generator battery, charging set, and switchgear in connection with the installation of a charging plant for electric cars.

Tenders were received from Metropolitan-Vickers Electl. Co., Ltd.; Wright Motors, Ltd.; Newtons; Crompton & Co.; Allgemeine Elektricitats Gesellshaft (per Chapman & Perry); Grammont, of Paris (per Chapman and Perry); Swedish General Electric Co.; Bruce H. Auld & Co.; British Electric Plant Co.; Chantrill & Co.; General Electric Co., Ltd.; Lancashire Dynamo and Motor Co.; and Allgemeine Elektricitats Gesellshaft (per Irish and Foreign Trading Corporation). The City Electrical Engineer, who examined the tenders, advised that insufficient drawings and particulars were supplied by most of the firms. The Streets Committee, in its report on the matter, states that the firms who furnished complete tenders and the necessary drawings and particulars, were:—General Electric Co., Ltd., £482; Bruce H. Auld & Co., £487; the Swedish General Electric Co., £576; Newtons, £605; Crompton & Co., £638. The Committee recommends the Council to adopt the tender of Messrs. Bruce H. Auld & Co., for the sum mentioned, as their time for delivery is six weeks, as against 11 weeks in the case of the General Electric Co., Ltd.—*Irish Builder and Engineer.*

Public Lighting Committee. Accepted:—

Flame arc lamps (approx. £1,330).—General Electric Co., Ltd.—*Irish Builder and Engineer.*

Dundee.—Tenders for six different kinds of cable were recently considered by the Corporation Electricity Committee. In three cases the prices quoted for German productions were cheaper than those offered by British manufacturers, while in the other three, British offers were the lowest. The lowest British offer was accepted for each of the six contracts.

Epsom.—Urban Council. Accepted:—

Feeder cable (£1,690) and pilot cable (£189).—Union Cable Co.
Joint boxes and feeder pillars (£100).—W. Lucy & Co.

Halifax.—Tramways and Electricity Committee. Accepted:—

Circulating pump valves and pipework (£1,031).—Worthington-Simpson, Ltd.
Ejector plant. (£540).—Hick, Hargreaves & Co., Ltd.
Motors.—J. H. Holmes & Co.
Transformer.—Hackbridge Electrical Construction Co.

Japan.—The large destroyer which is being built in Japan by the Uraga Dock Co. is to be fitted with Metropolitan-Vickers impulse turbines, and the order has been placed with Vickers, of Barrow, and will be executed at the Trafford Park works, Manchester. The twin-screw turbines will develop 39,000 shaft-horse-power. For some time past the Japanese Navy has been displaying considering interest in this particular form of turbine, and the contract has come to this country because Japan, while herself manufacturing other forms of turbines, does not build this type.

Leicester.—Electricity Committee. For the building work required in connection with the extensions to the new generating station at Leicester, 18 tenders were received, ranging from £18,789 to £23,087. The Committee has accepted the lowest tender, that of J. Chapman & Sons, Leicester.

Liverpool.—Corporation. Accepted:—

Rotary-converter and switchgear for Marsh Lane power station, Bootle.—Metropolitan-Vickers Electrical Co., Ltd.

London.—UNDERGROUND ELECTRIC RAILWAY COS., OF LONDON.

Reconstruction of Tottenham Court Road stations, including the installation of escalators (£125,000).—J. Mowlem & Co., Ltd., and Waygood-Otis, Ltd.

ST. MARYLEBONE.—Electric Supply Committee.

Construction of workshop and administrative additions on the Aberdeen frontage of the generating station land (£16,807).—A. E. Symes. (Recommended.)

Constructional work required for the foundations of the 12,500-kW turbo-alternator set (£3,559).—Ashby & Horner, Ltd. (Recommended.)

Removal and making self-supporting the two steel chimneys for the existing 40,000-lb. boilers, providing gantries, flue extensions, and soot and grit catchers (£3,254).—Babcock & Wilcox, Ltd. (Recommended.)

Maidstone.—Town Council. Accepted:—

Table telephones for the departments at the electricity works, with junction boxes, cable, and batteries.—British L. M. Ericsson Co.

New Zealand.—WANGANUI.—The directors of the Wanganui Woollen Mills have accepted the tender of Messrs. A. G. Bignell, for £25,825, for the erection of electrically-driven mills.—*Reuter's Trade Service* (Wellington).

Portsmouth.—Board of Guardians. Accepted:—

Electrical fittings.—J. Southey.

Salford.—Electricity Committee. Accepted:—

Street lighting and general supply mains in certain streets in the Cholmondeley Road and Heaton Park districts (approx. £2,000).—W. T. Glover & Co., Ltd.

Tramways Committee.

200 tons steel tramway rails (£10 7s. 6d. per ton); 200 pairs of fish-plates (£13 7s. 6d. per ton).—Bolckow, Vaughan & Co., Ltd.

FORTHCOMING EVENT.

Institution of Civil Engineers.—Thursday, July 12th. At the Institution, Great George Street, S.W. At 8 p.m. Annual conversazione.

THE "ELECTRICAL REVIEW" SERVICE DEPARTMENT.

WE have to remind readers that Service Department inquiries should be accompanied by a stamped addressed envelope.

The makers or suppliers of the following devices are asked for:—

L. P. E. wireless crystal detector.

ECONOMIC turn-down lamps (double filament).

We are still without the address of Mr. F. V. Wood, who wrote us with regard to repulsion motors.

NOTES.

Correction.—We regret that in our issue of June 15th, reporting the visit of the Prince of Wales to the works of the G.E. Co., Ltd., Witton, Mr. E. G. Oaten's name was unfortunately misspelt—"Oten."

A Contract for 240,000 kVA. — Eight hydro-electric generators rated at 30,000 kVA each at 80 per cent. power factor, generating at 13,200 volts, three-phase, 60-cycle, at 112½ r.p.m., have been ordered from the Canadian Westinghouse Company, Hamilton, Ontario, by the Quebec Development Company. A directly connected exciter with a capacity of 225 kW at 250 volts will be supplied with each generator. The contract includes the installation of this equipment in the new plant of the Quebec Development Company at Isle Maligne, on the Saguenay River. The apparatus will all be built in the Hamilton shops of the Canadian Westinghouse Company. A potential development of 1,200,000 h.p. through the construction of a dam at the Grand Discharge from Lake St. John at the head of the Saguenay River is foreseen. Messrs. Price Brothers & Co., Ltd., of Quebec, will erect two new paper mills in which much of the new power will be used, and existing mills will be converted to the use of electric power. They have agreed to take from the company 200,000 h.p., perhaps the largest contract ever placed by a consumer for electric power. It is estimated that the saving of coal thus effected will amount to $1,500,000 yearly. The cost to Price Brothers of building the new mills and making alterations to the old ones is put at about $17,000,000.—*Electrical World.*

Conditions in Persia.—A correspondent (an electrician), who is thinking of going to Persia, would be pleased to hear from any of our readers with regard to the conditions and climate of that country, and the salary that would be considered reasonable.

Tales of Woe.—Acting on the suggestion "To our Electrical Correspondents," in our issue of June 22nd, one of the best-known municipal engineers in the North has sent us copies of two letters received by his "Complaints Department," which we reproduce below. There must be a vast number of amusing items and incidents such as these every year which are lost to the world for want of publication; why not follow this good example? Laughter lightens labour.

"Covered with shame and confusion must I confess that already have I erred and fallen from the straight path as regards my kettle—only for a brief moment can the current have been on, and the kettle empty, but alas! the mischief was done on the instant, and my beautiful kettle is now but a leaking wreck. Still, it is not such a hopeless wreck as it might have been, and will, I think, be comparatively easy to repair. This is but a poor return for your exertions on our behalf, and I am very sorry and won't do it again.

"Meantime will you tell my emissary (I am too ashamed to come myself) what is to be done?

"Yours faithfully," &c.

"After nearly a year of comparative peace and tranquillity, our electric stove—Adolphus by name—has been wounded. Not mortally, of course, as the unwounded parts are still functioning admirably, but the wounded part in question is quite devoid of life, has ceased to be, is—in fact—cremated. I am no professor of electrical nomenclature, and therefore the following description of the part affected may be quite inadequate, may even provoke a smile to your learned visage. Nevertheless, it is my duty to advise you of poor Adolphus's sorry plight, and I shall do so. Standing face to face with him—as man to man—you will find that on the hotplate to your right, the curly twirly things that twisted themselves round and round like serpents at play, are now no more. They committed suicide one bright sunny morning when Mrs. ——— was away from home. She blames me, of course. She says I must have spoken harshly to the poor things and frightened them. I plead guilty. I did speak harshly to them, I admit, but it was after they committed suicide, not before.

"However, the fact remains that they have gone from us, and as they are evidently quite necessary for the cooking of our annual Xmas mince, would you be so good as to ask one of your young men to procure a fresh supply of monkey gland, and come out and rejuvenate our dear Adolphus.

"With the compliments of the season," &c.

Educational.—L.C.C. AND NATIONAL CERTIFICATES.—The L.C.C. Education Committee has decided that permission shall be given for the Council's technical institutes to enter candidates for the examinations for the award of certificates issued jointly by the Board of Education and the Institution of Electrical Engineers. The Council will pay the school fee on behalf of institutes from which candidates are entered. It has also drawn the attention of the governors of aided institutions to this rule, but has informed them that the Council will not be prepared to make supplemental grants in respect of any additional expenditure involved.

Open Air Radio Demonstrations.—With the advent of the summer season the thoughts of dealers naturally turn towards the use of radio receiving sets outdoors, and there is no doubt that they have a wide sphere of utility at fêtes, garden parties, on the tennis court, and on the river. No anxiety need be felt on the score of suitability, for one of the four demonstration vans which have been equipped by the *Daily Mail* clearly indicates that excellent results can be obtained. Four such vans are now on the road: One is touring districts within a 50-mile radius of London, a second is patrolling the Birmingham district, the third is stationed in the West of England, and the fourth is just starting a tour of the coast towns. Two other similar vans are also being prepared for use in Scotland and the far north. The equipment consists of a Gecophone two-valve set in conjunction with a Gecophone single stage amplifier and a two stage power amplifier; each van has two "loud speakers." A novel feature is the aerial used on three of the vans. It was supplied by the General Electric Co., Ltd., and consists of a sectional bamboo mast 30 ft. high and a wire mesh aerial the dimensions of which are 12 ft. by 4 ft. This type of aerial has been tested over distances of more than 100 miles from the London broadcasting station, and excellent results have been obtained, the concert being reproduced to large crowds in Birmingham, Shrewsbury and in the West of England.

During the Whitsun holiday a similar type of van was used for demonstration at the Reading Football Club Fête; approximately 7,000 people were able to hear the opera distinctly from 300 to 400 yards away from the instrument. At this concert transmission from Paris, Cardiff, and Birmingham stations was received quite clearly.

It has been said that broadcasting is essentially an indoor amusement, but it is reported that receiving sets are being used to very good purpose out of doors. Wireless Service, Ltd., in association with Electrical Installations, Ltd., has equipped a punt for radio demonstrations on the Thames. At the extreme ends of the punt rise slender bamboo poles carrying the aerial, to which is coupled a two-valve Gecophone receiving set, together with a large "loud speaker" equipment. Some highly successful trips have been made in the punt, which has been able to prove in no uncertain fashion the practicability of river "wireless."

The City Accumulator Co. was summoned at Bow Street on June 22nd for causing an obstruction outside its West London branch, where a police-sergeant said between 50 and 60 people collected to hear a wireless loud-speaker. On the understanding that a smaller loud-speaker would be used, the magistrate dismissed the summons on payment of 2s. costs.—*Daily Mail.*

Legislation and Electricity.—In connection with the Royal Commission on Local Government, now sitting, evidence was submitted on behalf of the Electricity Commissioners as to the administrative position relating to the supply of electricity and as to the loans and functions of local authorities in England and Wales with regard thereto. The Commissioners' memorandum covers the field very broadly and clearly, and forms a valuable epitome of the powers and duties of local authorities, and of the Commissioners themselves, under existing conditions. According to the statement, the total amount of the loans sanctioned during the year ending March 31st, 1923, was £7,221,429; 123 applications were outstanding, representing about £4,285,000. The total amount sanctioned since January, 1920, was £32,206,882.

The Rating of Electrical Machinery.—The *Electrical World* reports that the Electric Power Club, U.S.A., at a recent meeting adopted an important resolution regarding temperature standards for electrical machines. The Club had two standards in operation: a limit of 50 deg. C. without overload guarantee, and a limit of 40 deg. C. with a 25 per cent. overload for two hours' guarantee—practically identical with the two standards now sanctioned for this country (though the former is not in use). These standards have now been dropped, and the Club has adopted as "recommended practice" the following rule:

"(a) An open-type general-purpose motor shall be capable of carrying full rated load continuously with a temperature rise not exceeding 40 deg. C.

"Note.—Such a motor should be so designed as to be capable of carrying sustained overloads (in no event exceeding 50 per cent. overload) within a temperature of 90 deg. C. (measured by thermometer)."

This, it will be noticed, is the method of rating to which we referred in a recent leaderette as being under consideration in the United States. The Club anticipates that during the ensuing year its members will probably give their unanimous support to the "single-rating temperature standard," and at the end of that time the recommendation will be submitted to the Club for definite adoption.

Fatalities.—While at work on the roof of a house in Bonnybridge, Stirlingshire, a slater met his death by electric shock. His body was found lying across two cables carrying current at 250 V, which passed over the roof of the house. It is supposed that he had slipped on the slates and gripped the cables in an effort to save himself.

In Messrs. Orr, Watt & Co.'s bridge-building works at Carfin, Lanarkshire, an apprentice riveter was killed recently through coming into contact with a live wire in the gantry.

Appointments Vacant.—Electrical engineer (£325) for the Bingley Urban District Council; resident assistant engineer (£5) for the Severalls Mental Hospital, Colchester; executive engineer (electrical and wireless), £725, for the Government of Hong Kong. (See our advertisement pages to-day.)

INSTITUTION NOTES.

Institution of Electrical Engineers.—LIQUIDATION OF THE COMPANY.—A special general meeting of Corporate Members and Associates of the Institution will be held on Thursday, July 19th, at 5 p.m., to receive the report and accounts of the liquidators. All creditors have been paid, and the property of the old Institution has been transferred to the Institution of Electrical Engineers incorporated by Royal Charter.

CONVERSAZIONE.—The annual conversazione was held on June 28th, at the Natural History Museum, South Kensington; the president, Mr. Frank Gill, and Mrs. Gill received the guests, who numbered over 1,500, and included the Rt. Hon. Lord Southborough, the Hon. Sir John A. Cockburn, Mr. R. A. Dalzell, Engineer Vice-Admiral R. B. Dixon, Sir Harry Haward, Sir Thomas L. Heath, Admiral of the Fleet Sir H. B. Jackson, Mr. W. W. Lackie, Sir Lynden Macassey, Dr. W. H. Maw, Sir Philip Nash, Mr. A. Page, Mr. Guido Semenza, Mr. Ll. B. Atkinson, Col. R. E. Crompton, Dr. S. Z. de Ferranti, Mr. J. S. Highfield, Sir Henry C. Mance, Mr. W. M. Mordey, Mr Roger T. Smith, Mr. C. P. Sparks, Dr. A. Russell (president-elect), Dr. W. Cramp, Sir James Devonshire, Dr. W. H. Eccles, Lieut.-Col. F. A. Cortez Leigh, Mr. C. C. Paterson, Mr. W. B. Woodhouse, and Mr. P. F. Rowell, secretary.

A programme of music was provided in the Central Hall by the String Band of the Royal Engineers, under the direction of Lieut. Neville Flux, F.R.A.M., and was followed by an excellent concert, in which the band took part; a concert was also given in the Reptile Gallery, and was highly appreciated.

ELECTION OF COUNCIL.—The ballot papers have been issued for the election of Council, and include in addition to the Council's nominations the following names:—Members: Mr. F. W. Purse, engineer and manager, West Ham electricity department; Mr. W. M. Selvey, consulting engineer; and Mr. J. N. Waite, chief assistant engineer, Stoke-on-Trent electricity department.

Associate Members:—J. H. Parker, deputy electrical engineer, Croydon electricity department. For Members there are eight nominations and five vacancies; for Associate Members, two nominations and one vacancy.

American Institute of Electrical Engineers.—Mr. Harris J. Ryan, Stanford University, Calif, has been elected president of the American I.E.E. for the administrative year beginning August 1st, 1923. The wide geographical distribution of the Institute's directors is indicated by the fact that 12 States and Canada are represented on the list. The annual report of the board of directors showed a net increase in the membership during the year of 1,035, the total membership on April 30th being 15,298.

Institute of Transport.—Several interesting papers were read and discussed at the Annual Congress held at Sheffield from June 14th to 16th. From the electrical standpoint, two of these were of special interest. The first was a paper by Mr. E. S. Rayner upon "Tramways from a Traffic Point of View under Existing Conditions," which, the author said, was "not to be interpreted as a tirade against motor omnibuses," although it showed that tramways were a necessity in large towns and cities and could deal more cheaply and effectively with mass passenger transport than any other system. Mr. Brysson Cunningham, B.Sc., read a paper comparing British and American methods of cargo-handling at ports. Different types of merchandise—coal, grain, &c.—were considered and broadly speaking, the paper showed that each country had something to learn from the other, while not being able to claim absolute superiority in methods and efficiency. Other papers read were: "Modern Trackwork and its Importance," by Sir Robert Hadfield, Bart.; "Railway Requirements of an Important Industrial Area," by Mr. J. A. Jenkinson; "Air Transport," by Major-General Sir W. Brancker, K.C.B.; and "Some Comparisons of British and American Methods in Road Construction and Maintenance," by Mr. A. Dryland.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the* ELECTRICAL REVIEW *posted as to their movements.

Mr. GEOFFREY H. ALABASTER (the son of Mr. H. Alabaster), who has spent many years in the Far East, recently returned home in order to take up a position on the board of directors of the ELECTRICAL REVIEW.

Mr. F. WHYSALL has been appointed Deputy Postmaster-General in New South Wales, in succession to Mr. E. J. Young, retired. According to the *Industrial Australian and Mining Standard*, Mr. Whysall has been 47 years in the service of the Post and Telegraph Department, and has had experience in every branch. In November, 1911, he was promoted Deputy Postmaster-General in Western Australia, which office he gave up in 1914 to assume the position of Chief Clerk in the General Post Office, Sydney.

The *Industrial Australian* states that Mr. J. E. DONOHUE, general manager and chief engineer of the Sydney Electric Light and Power Supply Corporation, Ltd., was presented by the staff in May with a gold wristlet watch on the occasion of his departure for England and America.

Mr. F. H. BLAXLEY has resumed his connection with the New Gutta Percha Co., Ltd., as technical and sales representative for the Midland area.

The address of Mr. C. Y. KNIGHT, Chief London Representative of the Morgan Crucible Co.'s carbon brush department, is now 45, Leinster Avenue, East Sheen, S.W.14. Telephone No., "Richmond 2017."

Hastings Town Council has referred back for further consideration the Electricity Committee's recommendation to make a grant of £500 to the electrical engineer on account of extra work in connection with the recent extension.

Mr. DAVID MANN FRASER, who has resigned his appointment as manager of the electrical department of Messrs. John Birch and Co., Ltd., will join the staff of The Sun Electrical Co. on August 1st as manager of the firm's Leeds branch.

Mr. L. JESSOP, of Messrs. Jessop & Boydell, Ltd., electrical contractors, Bradford, who is chairman of the Boys' Welfare Committee of the Bradford Rotary Club, was in charge of a party of thirty poor boys who, on Saturday last, were taken to Scarborough for the day by motor-coach and entertained at the expense of the Rotary Club. None of the boys had ever seen the sea before. The Bradford correspondent of the ELECTRICAL REVIEW was one of the four Rotarians present. The boys were the first batch of 200 lads to whom it is hoped to give a similar day's outing.

Mr. WM. PICKERSGILL, who is employed on the engineering staff of the Yorkshire Electric Power Co., was married to Miss CLARICE SHACKLETON, of Cleckheaton, on June 28th. Mr. Pickersgill is the eldest son of Mr. Albert Pickersgill, the engineer and manager of the Cleckheaton electricity works.

To commemorate the starting up of a 6,000-kW set by the Warrington Corporation, Sir PETER PEACOCK, the chairman of the Electricity Committee, has been presented with a souvenir set of photos of the members of the committee and of the Electricity Department officials.

Mr. E. P. BENNETT, formerly joint general manager for Simplex Conduits, Ltd., and who has recently completed a world circuit in the interests of that company, and Credenda Conduits Co., Ltd., J. A. Crabtree & Co., Ltd., and other manufacturing concerns, has now joined Messrs. Cargills, Ltd., export merchants, Balfour House, E.C.2, as manager and buyer for the electrical and general engineering departments.

Birthday Honours.—In the further list of Honours just announced we note the following: Sir A. J. Dorman, managing director of Dorman, Long & Co., Ltd., is made a baronet, as are also Sir William Plender, the well-known accountant, and Sir W. W. Rutherford, of Liverpool. Mr. John Priestman, of Sunderland, and Mr. D. T. Keymer (of Keymer, Son and Co., who represent important Indian interests in this country), have the honour of knighthood conferred upon them, while Mr. John Lee, the Controller of the Central Telegraph Office, G.P.O., is made a Commander (Civil Division) of the British Empire. Mr. Arthur Balfour, of Sheffield, President of the Association of British Chambers of Commerce, is appointed a Knight Commander of the Order of the British Empire, and Sir W. Guy Granet, of railway fame, becomes a Knight Grand Cross of the same Order.

Obituary.—MR. ARTHUR WADHAM.—We regret to record the death on July 3rd (following an operation in a nursing home at Carlisle) of Mr. Arthur Wadham, founder and chief proprietor of the *Machinery Market*. He was 71 years of age. He had been a writer on trade economics for many years. Between 40 and 50 years ago he led a Press agitation for cheaper patents, and some twenty years ago wrote a book on "Protection and Industry," in which he defended Free Trade for engineering interests.

Will.—The late Mr. W. H. WILCOX (W. H. Wilcox & Co., Ltd.) left £128,681.

NEW COMPANIES REGISTERED.

Vickers (Ireland), Ltd.—Private company. Registered in Dublin June 26th. Capital, £5,000 in £1 shares. To carry on business as steel makers, ironmasters, ironfounders, builders, electricians, &c. The subscribers (each with one share) are:—G. Ridgway, 32, Nassau Street, Dublin, engineer; R. H. Williams, 32, Nassau Street, Dublin, accountant. The first directors are not named. Secretary: R. Harley Williams. Registered office: 32, Nassau Street, Dublin.

Milligan's Wireless Co., Ltd. (12,754).—Private company. Registered in Edinburgh June 25th. Capital, £10,000 in £1 shares. To carry on the business of manufacturers of wireless apparatus and plant of all kinds, &c. The first directors are:—F. M. Milligan, 23, Renfrew Street, Glasgow, electrical accessories factor; F. R. Forbes, 692, Cathcart Road, Glasgow, engineer. Qualification, 100 shares. Registered office: 23, Renfrew Street, Glasgow.

Tungstalite, Ltd. (190,909).—Private company. Registered June 25th. Capital, £2,000 in £1 shares. To carry on the business of manufacturers of, and dealers in electric or gas lamps, electrical machinery, and other electrical or gas apparatus for lighting, heating, power, or ventilation, &c. The first directors are:—B. Wechsler, 77, Fairholt Road, Stoke Newington, N.16; W. M. Rogerson, 140, Bathurst Gardens, Kensal Rise, N.W.10; E. Wechsler, C. R. B. Leake, and G. F. Bye, no addresses given. Qualification, £100. Remuneration, £10 per annum. Solicitors: Blyth, Dutton, Hartley & Blyth, 112, Gresham House, E.C.2.

B.C.C. Syndicate, Ltd. (190,884).—Private company. Registered June 25th. Capital, £2,000 in £1 shares. To adopt an agreement with M. L. Desplaux and R. Cozette, to acquire patents and rights, and to carry on the business of carburettor manufacturers, mechanical and electrical engineers, manufacturers of motor vehicles and parts, &c. The first directors are:—J. H. Procter, 23, Hartington Road, Grove Park, Chiswick (secretary, Standard Yeast Co., Ltd.); E. C. Funnell, "Holmewood," Southern Road, Fortis Green, N.2; D. Brock, 50, Addison Avenue, Holland Park, W.14. Solicitors: Nash, Field & Co., 12, Queen Street, E.C.4.

Ewing Inventions, Ltd. (190,842).—Private company. Registered June 22nd. Capital, £500 in 1s. shares. To adopt an agreement with G. N. Ewing and V. Lloyd, and to carry on the business of electricians, mechanical engineers, and manufacturers of, and dealers in telephone, telegraph, wireless, and electrical apparatus, acoustical apparatus, motive power and light, &c. The first directors are:—V. Lloyd (life director), 3, Canfield Gardens, Hampstead, N.W., insurance broker. Solicitor: W. C. Crocker, Little Dune, "The Gallop," Sutton, Surrey. Qualification, 100 shares. Registered office: 21, Bucklersbury, E.C.4.

London Lead Oxide Co., Ltd. (190,899).—Private company. Registered June 25th. Capital, £25,000 in £1 shares. To acquire the business of a manufacturer of lead oxide and other chemicals carried on by E. J. Clark at Gravesend as the "London Lead Oxide Co."; also to carry on the business of electricians, manufacturers of electric batteries or accumulators, &c. The first directors are:—E. J. Clarke, "Cla-jen," Whipps Cross Road, E.11, consulting engineer, and director of Hart Accumulator Co., Ltd. (permanent director); A. F. Kerr, 34, Lennox Road, Gravesend, chemist and works manager. Qualification of E. J. Clarke as permanent director, 500 shares; of others, 250 shares. Registered office: 107, Bishopsgate, E.C.

Frecastle Electrical Imports, Ltd. (190,844).—Private company. Registered June 22nd. Capital, £500 in £1 shares. To carry on the business of importers and exporters of electrical and mechanical goods, &c. The first directors are:—H. E. Swaine, 18, New Hall Lane, Bolton; C. F. Barrow, Stork House, 23, Sutherland Road, Bolton; V. E. Whittaker, 9, Lowther Street, Green Lane, Bolton. Qualification, one ordinary share. Registered office: 13, Back Cheapside, Bolton.

General Radio Co., Ltd. (190,918).—Private company. Registered June 26th. Capital, £30,000 in £1 shares. To acquire the business carried on as the "General Radio Co." at Twyford Abbey Works, Acton Lane, Harlesden, and to carry on the business of electrical engineers, wireless telegraphy manufacturers, dealers in apparatus and accessories connected with electricity, wireless telegraphy, scientific or other research work, &c. The first directors are:—W. S. Stephenson, 86, Lauderdale Mansions, Maida Vale, W.; F. Wissler, Heath House, Blackheath, S.E.; A. Morphy, "Moorsfoot," East Sheen, Surrey; B. H. Morphy, 36, Lancaster Gate, W. Qualification, £100. Secretary (pro tem.): G. O. Mitchell. Registered office: 105, Great Portland Street, W.

Visso Lighting Corporation, Ltd. (190,858).—Private company. Registered June 22nd. Capital, £500 in £1 shares. To carry on the business of manufacturers of, and dealers in gas and electric lamps, mantles, lighting and heating apparatus and accessories, &c. Power is also taken to carry on business as telephone, wireless, and installation engineers, &c. The first directors are:—C. G. H. Light, 24, Lower Marsh, S.E.1, gas and electrical engineer; Mrs. V. J. Light, 24, Lower Marsh, S.E.1. Registered office: 24, Lower Marsh, S.E.1.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Mechanical Ads, Ltd.—Debenture dated June 15th, 1923, to secure £1,900, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: Major J. L. Willcocks, D.S.O., M.C., Stock Lodge, Stock, Essex.

Electrical Engineering and Equipment Co., Ltd.—Mortgage dated June 19th, 1923, to secure £1,000 and interest (a) on £500 at 5 per cent. per annum and 5 per cent. of the invoice price of goods sold from carbon department, with minimum of 7½ per cent. commission and interest; and (b) on £500 at 10 per cent. per annum. Property charged: Leasehold premises on first floor of 109 and 111, New Oxford Street, London. Holder: L. J. Hitchcock, 849, Harrow Road, N.W.

W. T. Rawcliffe, Ltd.—Debenture dated June 5th, 1923, charged on the company's undertaking and property, present and future, including uncalled capital, to secure all moneys which the guarantor (R. S. Owen, of "Lyndhurst," Stockport) may become liable to pay under two instruments of guarantee to bankers, not exceeding £2,000.

Enterprise Manufacturing Co., Ltd.—Satisfaction in full on May 15th, 1923, of debenture dated September 29th, 1922, securing £2,000. (Notified June 19th, 1923.)

Debenture charged on the company's undertaking and property, present and future, including uncalled capital, dated June 12th, 1923, to secure all moneys due or to become due from company to Westminster Bank, Ltd.

Morris & Co. (Stockwith), Ltd.—Mortgage debenture dated June 6th, 1923, to secure £15,000, charged on the company's undertaking and property, including uncalled and unpaid capital. Holders: Westminster Bank, Ltd., 41, Lothbury, E.C.

A. J. Bennett & Weaver, Ltd.—Debenture dated June 11th, 1923, charged on the company's undertaking and property, present and future, including uncalled capital, to secure all moneys due or to become due from company to Barclay's Bank.

Torpoint Electric Supply Co., Ltd.—Mortgage debenture dated June 11th, 1923, to secure £5,500, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: L. James, Hill Crescent, Essa Road, Saltash; T. P. Lyne, 1, The Crescent, Torpoint; H. J. Oliver, Vine Cottage, Torpoint; A. J. Reynolds, 1, Coryton Terrace, Torpoint; and Dr. J. A. Samuel, North Hill House, Torpoint.

Dunn & Co. (Cheltenham), Ltd.—L. Vizard, of 2, Clarence Parade, Cheltenham, ceased to act as receiver or manager on June 20th, 1923.

Durham and District Electric Traction Co., Ltd. (79,285).—Return dated May 8th, 1923. Capital, £30,000 in £1 shares. Seven shares taken up. £7 paid. Mortgages and charges, nil.

CITY NOTES.

Edison Swan Electric Co., Ltd.

The annual meeting was held at the Cannon Street Hotel, E.C., on June 27th. Mr. C. F. Spencer presided, and moved the adoption of the report for the year ended June, 1922, which was referred to in the ELEC. REV. for June 29th. He said that they met first to consider the report and accounts; secondly, to consider resolutions dealing with the reduction of the share capital, by writing off 16s. per share from the ordinary shares; and, further, in order to carry this into effect, to pass a resolution varying the Articles of Association. They had then to hold separate meetings of the preference and ordinary shareholders to consider the proposed modification of rights of each class of share. These meetings followed close upon each other, and he proposed to deal with the whole situation in one speech. The general circular which had been issued explained that situation. It dealt with the appointment of his colleagues and himself as directors, and it explained shortly the reasons which had induced them to recommend the scheme. In the balance sheet the loan from the company's bankers stood at £315,150, as against £223,800 in the previous accounts. The bankers had taken a very keen interest in revitalising the company, and their assistance had been the means of extricating them from many difficulties which beset the company in May, June and July, 1922. Knowing the value of that help he felt that they were under a deep debt of gratitude to them. At some future date they would have to deal with the question of paying off the bank loan, and they hoped that before the end of the year it would have been substantially reduced. When the next balance sheet was placed before the shareholders it would show a very different state of affairs from that disclosed in the balance sheet then before them, and would demonstrate that loss had been con-

verted into profit, and that they had at least made progress in laying the ground-work for repaying their bank obligations. Sundry creditors and credit balances amounting to £218,469 included many old liabilities of a non-recurring nature, amounting to over £50,000, which had, since the date of the balance sheet, been discharged. Reference was made in the last report to the relations between Philips Glow Lamp Works, Ltd., and this company. Agreement had been reached and the whole matter settled on a satisfactory basis, and payment made to the Philips Co. of a sum which was included in the £50,000 already mentioned. Patents, goodwill, &c., stood at £239,699, as compared with £390,432 in the previous accounts. Whilst the board would have preferred to still further write down this asset, such a course was not practicable. They had completely written off £21,380 expenses of ordinary share issues, underwriting, brokerage, &c., which appeared in the balance sheet dated June 30th, 1921. Investments figured in the balance sheet at £65,378, which was cost, and their cost was below their market value. Arrangements had been made to dispose of their holding of 50,000 £1 ordinary shares in the Enfield Ediswan Cable Works, Ltd., and they had been sold at cost plus any dividends which might accrue to June 30th, 1923, whilst the Edison Swan Co. had retained its selling rights under a new agreement. The company was also interested in the Altrincham Electric Supply, Ltd., and had £3,885 invested in that undertaking, from which it had received dividends during the present year equal to 36 per cent. on the capital invested therein. £25,368 was invested some years ago in shares of the Brotherton Ediswan Tubes and Conduits, Ltd., but as this concern was now in the Receiver's hands, the aforementioned amount had been added to the capital losses. The item of investment also included first and second debenture stock of the Edison Swan Co., to the extent of £11,248, which was purchased at a discount. It therefore needed no words of his to indicate that the investments were valued on the side of safety. The book cost of the freehold property, fixtures, fittings, office furniture, plant and machinery had also been reduced by £31,948. In regard to stocks (including work in progress, £328,473), in such a highly technical business as lamp and electrical accessory manufacture and supply, it was necessary that large stocks should be held to meet the diversified demands due to the different systems of supply of electrical energy prevailing in this country. At least 40 per cent. of the total valuation of stocks represented work in progress and raw materials to be used in manufacture, and as the raw materials only represented part of a year's requirements it was abundantly clear that future loss in this direction was unlikely. The balance of 60 per cent. was made up of finished stock ready for sale, and before arriving at the sum which now represented this asset they had made liberal deductions to meet depreciation due to changes in fashion and other causes. Such a method was the only safe course to adopt, and any other would endanger the smooth running of the business, and might involve a recurrence of past troubles. The board was convinced that the shareholders would approve this ultra-conservatism in stock estimation, and when they reflected that Europe was in the midst of an economic conflict which might have serious consequences for British trade, it behoved them to establish stock values on as firm a basis as possible. Turning to the item of debtors, they had valued the amounts owing to them at £151,990, having made liberal provision for bad and doubtful debts. The deficiency account was set out in detail. To the debit balance of £289,720 shown in the previous account had to be added the loss of £283,204 for the year under review. This loss was largely due to depreciation in values of stocks consequent upon the slump in trade generally. Capital losses of £239,940 arose on the revaluation of the capital assets. After deducting £47,122, being the net balance of certain reserves embraced in the previous accounts, from the aggregate losses, they had a net amount of £765,742 to provide for. When the board found that this deficiency existed they decided, after mature deliberation, to deal with it, and the only course open to them was to place the matter frankly before the shareholders and submit the proposals which were before them. It obviously could not be of any advantage for shareholders to retain shares of the nominal value of £1 when the assets of the company showed so large a deficiency. It was surely far better for them all to recognise the heavy losses sustained, and to give the directors the opportunity to place the undertaking on a dividend-paying basis. He fully realised that the presentation of an account of this description must be most unsatisfactory to the shareholders. He was afraid that, as with many other manufacturing concerns, large quantities of stocks were built up during the so-called "post-war boom." That boom was very short-lived, with the result that stocks manufactured at high prices were left on the hands of manufacturers, and, in the absence of large reserves, the only method of dealing with resultant losses was by drastic reduction of capital. Unless a scheme for reduction of capital was carried into effect any profits earned or which might be earned thereafter, would have to be utilised in writing off this deficiency until it was extinguished, and, consequently, the prospect of payment of any dividend to shareholders would be remote. The ordinary shareholders were asked to make a large sacrifice and the preference shareholders were invited to agree to modifications which were not unfair, and these embraced the cancellation of participating rights and eleven months' arrears of dividend. It was proposed to add ¼ per cent. to the 7 per cent. fixed cumulative dividend. The proposals had received the approval of a large number of shareholders, and they commended them as the best they could conceive to meet the position. He became associated with the control of the affairs of the company last June, and they had carefully examined every phase of the company's activities and operations. They had endeavoured to effect as many economies as possible, and had made substantial reductions in works establishment charges, cut down sales costs by placing each sales branch on as nearly a payment-by-results basis as possible, reduced general standing charges substantially, cut down the ratio of unproductive labour to productive labour, turned losing departments into profit-making sections, and last, but not least, established a system of co-operation throughout the whole of the principal members of the staff. Their products required much skill in manufacture, great technical ability in controlling manufacture, and they were of so diverse a character that selling required highly technically-trained depôt managers and salesmen. They had endeavoured to get unification of ideas and the directors and chief officials met together on committees to define their common aims and ideals. At every meeting the fullest possible discussion took place, and every problem which was brought before the committees received the constructive criticism of experts, and in this way the board had secured the backing of an excellent staff, which only required encouragement to make its ability felt. They intended to place the staff members of this committee, and possibly others at a later date, on a basis of payment by results, their remuneration showing some relation to profits earned. Their advertising was now very efficient, and they realised the power of their 5,000 shareholders to increase the profits by asking their friends to buy their products. If each shareholder undertook only to mention Ediswan lamps and products to ten of his friends, it would be a direct appeal to 50,000 people, so he asked them to give every assistance in increasing the sales. He had referred quite briefly to conditions in Europe, and they might have a reflection of them in this country, resulting in a further reduction of the purchasing power of the people, so every help which they could get from their shareholders would be welcomed. With reference to the current year's trading he could assure them that when the accounts were presented they would show that substantial profits had been earned.

Mr. A. F. Berry, in seconding, said he sincerely hoped, for the sake not only of the Edison Swan Co., but the whole electrical industry, that they had seen the turning point in their chequered career. A number of shareholders then asked questions on the accounts and the policy of the company.

Mr. Noble said that the company must become a competitive force in the electrical world. That was the key to the whole situation. The chairman pointed out that the policy of the board had been a very progressive one, both last year and this year, and they hoped to increase its intensity in the coming year.

The adoption of the report and accounts was carried with one dissentient.

Special meetings followed, at which the resolution already published in the Electrical Review was approved, and the consequent alterations in the Articles were authorised.

General Electric Co., Ltd.

The directors report that the net profits for the year ended March 31st, 1923, amount to £751,486, plus £217,024 brought forward, making £968,510. After deducting debenture stock interest £243,775, depreciation £182,031, contribution to pension fund £14,219, dividend of 6½ per cent. per annum on "A" preference shares for the year £115,979, dividend of 7½ per cent. per annum on "B" preference shares for the year £132,786, it is proposed to pay a dividend of 5 per cent. per annum on the ordinary shares for the year, requiring £105,599, leaving to be carried forward, subject to Corporation Profits Tax for the year, £174,121. The net profit shows an increase of nearly £200,000 over that of the previous year. In view of the fact that for the first three months of the year the company's principal works were at a standstill, owing to the lockout in the engineering industry, and the general business during the summer was nearly paralysed, the results are more satisfactory than at one time the directors dared to hope, and are indicative of the potential earning capacity of the company in a normal year. The improvement is due in the main to a general increase of activity in all departments of the company's home business during the latter half of the period under review. The overseas branches of the company, which were the last to feel the effect of the trade depression, are proving the last also to feel the recovery, and have not contributed to the results of the year. The liquid resources of the company, in cash and realisable securities, amount to £840,000, an increase of over £700,000 on the previous year. It has been the policy of the directors to strengthen these resources, so as to be free to take full advantage of the business that may be expected now that there is a fair promise of an improvement in trade. To this end they disposed during the year of the unissued balance of 94,210 "A" preference shares and 177,109 "B" preference shares on favourable terms. The greater activity prevailing in the company's business is reflected in the number of employés, which at March 31st stood at 15,000, and is thus approaching the normal figure.• Meeting: London, July 12th.

South Wales Electrical Power Distribution Co.

The annual meeting was held at Cardiff on June 26th. Mr. Westgarth Foster-Brown, who presided, spoke of the difficulties experienced on account of overloaded plant of the Treforest power station. The plant could not possibly be shut down for a sufficient time to enable renewals to be carried out, and the purchase of additional plant had been prevented by the difficulty of raising fresh capital. The Treforest Consumers' Company, however, solved the problem by raising sufficient capital among themselves, a new 15,000-kW turbo-generator was purchased, and this was now about to commence work. Owing to the uneconomical running of the station the costs had not fallen in the same proportion as the revenue, and the result was therefore rather worse than that of 1921. During the last two months of the year the position improved considerably, and this improvement had been maintained. With the new set in commission, and the continued rapid growth of the demand, the outlook for the current year was good, and it was probable that the estimated results given in the recent prosopectus of the South Wales Power Co., Ltd., would be exceeded. During the year that company had been advised by its consulting engineers that if future demands were to be adequately met, a second 15,000-kW set would have to be installed. As the existing arrangements between it and the Treforest Consumers' Co. were not well suited for raising the necessary capital for this purpose, the opinion of financial experts was taken. They considered that the obligation to pay the shareholders of the Treforest Consumers' Co. 10 per cent. upon their capital should be abandoned, and new relations were being established. Under these the South Wales Power Co., Ltd., would hold all the loan and share capital of the Power Distribution Co. This would be effected by the issue of new securities to stock, and shareholders of the latter company. The new securities would be more marketable than the present holdings, and the whole scheme would result in their receiving sums as dividends much in excess of the £3,000 stipulated in the July, 1920, agreement. In order to facilitate the carrying out of the new arrangement, one board of directors would serve for the two companies, and to enable this to be done several directors had intimated their willingness to resign.

Edmundson's Electricity Corporation, Ltd.

The report for the year ended March 31st, 1923, states that after providing for income tax, mortgage and note interest, and debenture stock charges, the net profit amounts to £52,103, as compared with £31,369 for the previous year. With the balance of £15,512 brought forward, the total profit is £67,615. After allowing for the interim dividends of 3 per cent. paid upon the cumulative preference shares and non-cumulative preference shares, there remains a balance of £55,615, which it is proposed to apply as follows:—Final dividend of 4 per cent. upon the cumulative preference shares, making 7 per cent. for the year, £8,000; final dividend of 4 per cent. upon the non-cumulative preference shares, making 7 per cent. for the year, £8,000; dividend of 7 per cent. on the ordinary shares, £16,800; carried forward, £22,815. During the year the balance of the 6½ per cent. three-year notes was paid off. Meeting, July 11th.

Globe Telegraph and Trust Co., Ltd.

In presenting the report and accounts at the annual meeting on June 26th, Sir John Denison-Pender said that the gross receipts had increased by £7,706 to £354,428. The receipts from the Eastern and Associated companies had improved owing to the return upon shares purchased with the proceeds of the Submarine Cables Trust certificates. In addition to an increase of 1 per cent. in the dividend upon the Mackay Co.'s common shares, a bonus of 10 per cent. had been received, one-half of which came into the accounts under review. The slight reduction in income tax had increased their dividend from the Anglo-American and Great Northern Companies by £727. These increases amounted to £11,015. Upon the other hand, £318 less had been received from the Submarine Cables Trust; the income from American holdings was £371 less; the interest on deposits, &c., was lower by £652; and the receipts from the Direct United States Cable Co. had fallen by £1,969; a total decrease of £3,310, leaving a net increase in income of £7,706. Expenses were less by £4,473. The Direct United States Cable Co. had gone into liquidation, and from the receipts on account of its holdings the company would repay £60,000 which it had borrowed in order to take up its full allotment of the new issue of the Eastern and Associated companies' shares. The amount of £1,200 held in suspense was found sufficient to meet the corporation profits tax which, therefore, did not appear in the accounts.

Waygood-Otis, Ltd.

Mr. H. C. Walker (chairman), speaking at the annual meeting of the company on June 26th, said that in spite of keen competition and difficulties the usual share of contracts had been secured. He made special mention of the lifts installed at Bush House, Messrs. Lyons's new "Corner House," the Angel Underground station, and other places. Their manufacturing facilities had been augmented by the completion of the alterations and additions to their factory, mentioned at the last meeting.

Lisbon Electric Tramways, Ltd.

The chairman of the company (Mr. Ludwig Breitmeyer) presided at the annual meeting, held on June 29th. In moving the adoption of the report and accounts (*vide* Elec. Rev., June 22nd, p. 988), he said that the appointment of a commission of four by the Camara and the company jointly, to investigate and arbitrate upon disputes in connection with the adjustment of tariffs, had resulted in the clearing away of the interminable delays which formerly characterised this business. Although, owing to a strike during the year, the number of passengers carried had fallen by 7,763,000, the increase in tariffs had enabled an additional revenue of Esc. 4,973,000 to be earned. This more than counterbalanced the effect of increased costs. The fall in the sterling value of the escudo had resulted in a severe loss to the company, but the Commission referred to above had recognised the justice of increased tariffs and approved them. During the first part of the current year the exchange had remained steady and improvement was hoped for.

Referring to the accounts, the chairman pointed out that the debenture interest had been earned and the loss brought forward had been reduced. The improved conditions which had prevailed so far during the present year should prove of considerable benefit to the company. The company was faced, however, with two adverse factors: the ever-growing expenditure and the additional complicated taxation recently introduced by the Government. The present fares were much too low if adequate profits were to be earned and the necessary depreciation provided for, and it was hoped that a further increase in tariffs would be sanctioned in the near future.

Crompton and Co., Ltd.

The directors' report for the year ended March 31st, 1923, shows that the result of the year's trading after providing for depreciation, interest on debentures, directors fees, &c., was a loss of £7,185, which, deducted from the carry forward of £18,084, left a balance of £10,898. The preference dividend of 7 per cent. for the year absorbs £9,808, leaving a balance of £1,090 to be carried forward. "During the year scarcity of orders, restricted prices and general trade depression resulted in a loss on working. The directors are, however, pleased to report that toward the end of the year an improvement occurred and this improvement has continued since the close of these accounts."

Meeting held in London yesterday, July 5th.

Zinc Corporation, Ltd.

Referring to the Corporation's subsidiaries at the annual meeting, held on June 27th, the chairman (Mr. F. A. Govett) said that the Electrolytic Zinc Co. was now producing 40,000 tons of refined metal. For six years no dividend had been received from this source, but now they were very near a dividend at last. With compound interest added, he calculated that £200,000 had been spent in this direction, and he hoped that this expenditure would soon be justified.

Calcutta Tramways Co., Ltd.

Mr. J. G. B. Stone (chairman), presiding at the annual meeting on June 20th, said that the cost of the new rotary converter plant stood in the accounts at £23,261, and part of the old d.c. plant had been written off, representing £20,000. The balance of the d.c. plant (500 kW) was being retained as a stand-by. Owing to the increase in fares and to a shorter period of strikes, a comparison with 1921 was difficult. The results, however, were satisfactory, for with an increase of 16 per cent. in the car-mileage there had been an increase of 39 per cent. in the receipts. A noticeable improvement in the year's working was the increased volume of traffic in Howrah. The cost of fuel was higher, but a considerable saving would be effected by the use of a bulk supply from the Calcutta Electric Supply Corporation. During the last 11 days of the period under review and 22 days in the current year, a strike had occurred on account of the refusal of the company to grant further concessions with regard to wages and conditions. The company maintained a firm attitude and ultimately the employés resumed work unconditionally. The continuity of the company's services was still interrupted owing to the failure of the responsible authorities to complete the Southern Approach of the Kidderpore Bridge. This condition had subsisted for four years and affected traffic on the Kidderpore, Alipore and Behala sections. The political and trade outlook might be said to appear fairly good, and he hoped that the normal progress of the company would be maintained.

German Companies.

The *Trustee Bank for Electrical Industry*, of Berlin, proposes to pay a dividend at the rate of 25 per cent. out of net profits of 9.42 millions of marks in 1922, comparing with 6 per cent. and 1.68 millions in 1921.

The report of the *Robert Bosch Co.*, of Stuttgart, states that the Geneva branch again incurred a loss and business in the Northern countries was by no means satisfactory in 1922. On the other hand, the trade with other foreign countries experienced an increase and the total turnover was greater than in the previous year. The net profits are 191.77 millions of marks, as against 0.72 million in 1921, and the dividend is at the rate of 150 per cent., as compared with 25 per cent.

The report of the *German Atlantic Telegraph Co.*, of Cologne, states that the resolutions passed at the last general

meeting regarding the absorption of the German-South American Telegraph Co. and the East European Telegraph Co. had been carried into effect, so that the accounts for 1922 comprise the working results of the three companies combined. The compensation received from the Reich for the ceded cables had for the most part been devoted to the acquisition of materials for the construction of the proposed cable between Emden and the Azores. Negotiations were still proceeding with the Governments concerned with regard to the projected re-establishment of the cable between Emden and Vigo and the laying of a cable between Emden and London. The net profits for 1922 are returned at 3,457,000 marks, permitting of the payment of a dividend at the rate of 7 per cent. on the ordinary share capital of 37,500,000 marks.

Prospectus.—*The Lima Light, Power & Tramways Co.* (*Las Empresas Electricas Asociadas*).—An offer of £1,500,000 6 per cent. first mortgage debentures at £90 per cent. has this week been publicly made by Messrs. J. Henry Schroeder & Co., and the amount was promptly over-subscribed. According to information published in the prospectus, the company now owns and operates hydro-electric and steam power stations of a combined capacity of 25,000 h.p., high-pressure transmission lines, a distributing system in the city of Lima, Callao and the surrounding districts, and a railway and tramway system consisting of about 140 km. of track, together with the requisite rolling stock. All the lines are equipped and operated electrically. The company also operates the lines of the Lima Railway Co., Ltd., under a lease contract extending to 1937, as regards the line from Lima to Chorillos, and to 1952 as regards the remaining lines, and it controls the Lima Gas Co., the only existing competitor for public and private lighting, through ownership of a majority of its share capital. The following table shows recent progress of the company's business :—

	Passengers carried.	Energy produced.	Number of customers. Lighting.	Power.	H.P. contracted for.
1921 ...	43,543,820	51,351,233 kWh.	24,984	997	8,799
1922 ...	46,620,429	60,399,671 ,,	25 889	1,013	9,078

In 1922 the Government, with the approval of Congress, extended from 1969 until 1989 the life of the concession under which the Lima-Chorillos and Lima-Callao tramway lines are operated, and sanctioned an important increase in the tariff on the Lima-Chorillos line. The Government also agreed to grant to the company exemption for 50 years from 1922 from all new taxation, and to allow the company to import all machinery and material required for the extension and modernisation of the plant free of duty during five years. The Municipality has granted to the company a concession for the distribution of electrical energy for lighting and power in the city of Lima for 50 years from 1922, and the right to sell current by meter. It has, moreover, extended the time of the concession under which the city tramway service is operated from 1965 to 1985, and authorised an increase in the tariff from 5 to 10 cents. The concessions under which the company operates its water-power plant are three in number, two being perpetual, and the third expiring in the year 1950. The company entered into a contract with the Impresa Elettriche dell'America Latina in 1922 for the provision of capital for the execution of an important programme for the extension and modernisation of the installations in Lima covering the following work, *viz.*, the substitution of the existing system of overhead transmission and distribution within the city radius by a completely new network of high- and low-pressure underground cables, involving the provision of over 200 miles of cable; the construction of static transformer sub-stations throughout the city for the distribution of electrical energy in place of the existing overhead transformers; the installation of about 30,000 house service meters for power and lighting; the modernisation and extension of the hydro-electric and steam plant in the power stations; the supply of a large number of new tramway cars; the construction of a number of new converter sub-stations for the tramway service, and the relaying of the tramway tracks. Part of the projected work has already been carried out, and it is estimated that the completion of the whole programme will take about three years, and will eventually result in a very large increase in the earning capacity of the undertaking, besides effecting a substantial reduction in the operating costs, and greatly increasing the reliability and efficiency of the power, lighting and tramway systems. The contractors have agreed to place orders for part of the new equipment in Great Britain. The gross and net receipts of the company are as follows :—

	Gross.	Net.
1921	£P 749,410	206,646
1922	803,177	232,441

The proceeds of the present issue will be applied in repaying the outstanding 5½ per cent. debentures and in paying off the floating debt of the company, and the balance will be utilised in defraying the capital expenditure necessary for the further extension and improvement of the company's tramway service by the construction of an additional 10 km. of tramways, the building of a new passenger station in Lima, the increase and improvement of the rolling stock, and for the general purposes of the company, whose business is increasing in every department.

Stock Exchange Notices.—Applications have been made to the Committee to allow the following to be officially quoted :—

Central Electric Supply Co.—£650,300 secured and guaranteed redeemable notes, within Nos. 1 to 1,282 (£50), 1 to 2,465 (£100), 1 to 264 (£500), and 1 to 370 (£1,000).

Lancashire Electric Light and Power Co.—212,500 7 per cent. cumulative participating preference shares of £1 each, fully paid, Nos. 1 to 212,500.

Oxford Electric Co.—£50,000 6 per cent. debenture stock.

Urban Electric Supply Co.—240,000 ordinary shares of £1 each, fully paid, Nos. 1 to 240,000, and 250,000 6 per cent. cumulative preference shares of £1 each, fully paid, Nos. 300,001 to 550,000.

Dealings in the following have been specially allowed by the Committee under Rule 159 :—

English Electric Co.—£1,250,000 6 per cent. convertible debenture stock, issued at 97 per cent., partly paid and fully paid.

Western Electric Distributing Corporation.—14,245 6 per cent. cumulative preference shares of £1 each, fully paid, Nos. 1 to 14,245; 35,755 6 per cent. cumulative preference shares of £1 each, 10s. paid, Nos. 14,246 to 50,000; 31,538 ordinary shares of £1 each, fully paid, Nos. 1 to 28,278, 36,279 to 39,153, 43,016 to 46,040, 49,341 to 49,440, and 29,741 to 50,000; and 18,462 ordinary shares of £1 each, 2s. 6d. paid, Nos. 28,279 to 36,278, 39,154 to 43,015, 49,041 to 49,340, and 49,441 to 49,740.

Rangoon Electric Tramway and Supply Co.—£200,000 5 per cent. mortgage debenture stock.

Tokyo Electric Light Co. (Tokyo Denko Kabushiki Kaisha).—£3,000,000 6 per cent. sterling bonds, issued at 94 per cent., partly paid and fully paid.

Agricultural and General Engineers, Ltd.—In a letter to the shareholders the secretary states that as a result of the engineering lock-out, substantial writings off of stock, and the depression in agriculture and trade generally, the combined trading of the associated companies for the year ending March 31st last shows an approximate loss of £150,000. The board is unable to recommend the payment of dividends due on June 30th on the first and second cumulative preference shares. Reorganisation of the capital is to take place.

Brisbane Electric Tramways Investment Co., Ltd.—Dividend of 4s. per share, free of tax, on ordinary shares, making 8 per cent. for the year, carrying £39,325 forward, subject to corporation tax. Refund is to be made to preference shareholders in respect of income tax over deducted from previous dividends.—*Financial Times.*

St. James' & Pall Mall Electric Light Co., Ltd.—Interim dividend at the rate of 7 per cent. on the preference shares and 10 per cent. per annum on the ordinary shares for the half-year.

Marconi International Marine Communication Co., Ltd.—Final dividend of 7½ per cent., making a total of 12½ per cent. for 1922.

Clontarf & Hill of Howth Electric Railroad Co.—The directors have declared an interim dividend at the rate of 3 per cent. per annum (3s. per share).

Chile Telephone Co., Ltd.—A dividend of 3s. per share net on the ordinary shares is announced.

Western Union Telegraph Co.—Dividend of 1¾ per cent. on the common stock for the past quarter.

STOCKS AND SHARES.

Tuesday Evening.

The second half of 1923 has entered the Stock Exchange markets to find them suspicious of foreign political developments and disposed to go slowly in view of the outpouring of new capital issues at home. There is just a vague hint of the possibility of a rise in the Bank Rate, the idea gaining notice not because of any lack of supply of money, but from the knowledge that the Bank of England looks none too kindly upon the manner in which capital is being raised in large amounts for enterprises outside this country. It is natural enough that the man who has hitherto been taking one per cent. from deposit rates on money lying at his bankers should begin to ask whether this is enough, and to examine the claims of some of the newly-issued securities that offer 6 per cent. or more, though he may feel that prices of many existing stocks and shares stand sufficiently high.

This explains, to some extent, the rush there was for the Tokyo Electric 6 per cent. debenture issue at 94, the lists for which closed within half an hour of their opening in spite of there being three million pounds of stock offered. The Lima Light, Power & Tramways Co. was equally successful in promptly placing £1,500,000 6 per cent. first mortgage debentures at 90. Peru is not altogether a favourite hunting ground for British investors, but the bonds, which offered 6¾ per cent. yield on the money at the issue price, are not at all badly secured. Several Austrian industrial issues—one hesitates to use the word "investments" in connection with Austria—are working their way towards a public issue of shares, the cordial reception recently given to the Austrian Government Loan

having stirred up interest in the country. The sharp fall in Mexican securities, Government and Municipal, received a check upon the semi-official announcement that no hitch had occurred in connection with the Government's intention to proceed with its scheme for dealing with Mexican Bonds, and calling for deposit of these latter under the proposals that had been formulated. But Mexican Utilities have again fallen.

Pronounced weakness overspread all the markets in which anything like a speculative account existed. We have pointed out before that, in some of the Underground stocks, the recent buyers had perhaps taken more stock than they could conveniently pay for. This somewhat weak bull account has consequently had to be weeded out, and in the process, Metropolitans have dropped 2½ points, Districts losing only 10s. Underground issues are on the heavy side, though showing no special change. The Railway market as a whole has had this week a further cause of unsettlement in the threats of striking on the part of some sections of the men who dislike the idea of their agreement with the companies being carried out, which involves a further reduction in wages. Against this, and the faint hint of dearer money, it is hardly to be supposed that speculative stocks can make headway, and there is consequently no surprise felt at the dulness of the Home Railway quotations.

Electricity Supply shares are very steady, and have not suffered from the prevailing depression in other parts of the House. There is perhaps less buying going on, but, at the same time, no liquidation has troubled this market in the manner from which other departments have suffered through necessity on the part of speculators to raise money for other obligations: for stags to meet their calls on new issues, and for the income-tax payer to provide his July contribution to the revenue. Londons are ½ up at 4 7/16. Edmundson's Supply Corporation's report explains the reason for the sustained rise in the prices of shares. The profit comes out at £52,000, or £31,000 more than that of last year. The ordinary shares received 7 per cent. dividend, this being the first paid for 17 years. The non-cumulative preference received their full dividend. The chairman will have a pleasant task in meeting his fellow proprietors at the meeting on July 11th. Ediswans are better at 4s. 6d., and other manufacturing shares show little change.

The Shanghai Electric Construction Co. is about to divide 40,000 shares of £10 each into 400,000 shares of £1 each, this being the latest recruit to the ranks of the companies which are giving their shareholders a greater elasticity in marketing their shares by reason of the more flexible nature of dealings in the £1 share as compared with those of a higher denomination.

British Electric Traction ordinary stock has recovered about a point of the dividend deducted last week. The 6 per cent. preference is quoted 98 x.d., Anglo-Argentine Tramways first and second preference are both ex-dividend, and so is London United Tramways debenture. The market on the whole is inclined to the dull side, but British Columbia Electric stocks are better, the preferred and deferred both recovering 17s. 6d. of the dividend of £3 17s. 6d. taken off last account day.

Weakness has developed in the market for cable stocks and shares. Eastern ordinary is down 5½ points, Globes 15s., Eastern Extensions 17s. 6d., Westerns 12s. 6d. For this heaviness the recent statement of Mr. Marconi in connection with long-distance wireless is held in some directions to be responsible, though the more probable reason is the realisation of a few shares in a market indisposed by general conditions to take more than it can see its way to dispose of at once. One of the weekly papers reports Sir J. Denison-Pender as having stated, at the Globe Telegraph meeting last week, that wireless was "pushing the cable companies hard." What he actually remarked was that at the present time "wireless was pushing hard." Sir John went on to say that the Globe Co. had a strong reserve fund, and that the Associated Cable Companies were in a similar position. That was a backbone which would enable them, if they had in the future to fight, to fight successfully. The observer will no doubt assume that so far from fighting each other, the cable and the wireless companies are likely to do all they can to promote harmony of working. Concurrently, with the dulness in cable stocks, Marconis have been a better market, the shares showing a rise of 2s. 6d. on the week at 2 5/16 middle. Great Northern Telegraphs are 10s. lower at 27½ and, of the Telephone shares, United River Plates further gave way to 6¼.

Callenders have improved to 50s., and the preference at 23s. 9d. are the same price ex-dividend as they were cum dividend. General Electrics are rather heavy, owing to a little disappointment at the dividend being no more than 5 per cent., the same as that of a year ago. Siemens continue about 17s. 6d., and other manufacturing shares have remained without alteration. Babcock & Wilcox are still 2 3/16. The rubber share market is heavy owing to the complete lack of resiliency in the market for the raw stuff. Iron, Steel and Armament shares came under the same causes for depression which ruled elsewhere. The Tokyo scrip opened at 3s. 4d. premium, dropped to 7s. 6d. discount, and rallied to "par," the issue price of 94. River Plate Electric preference is 1¼ better at 98. Cordoba Light & Power shares at 7s. 6d. are 9d. down, and London United Tramways preference, at 3s. 6d., have given way. Brush ordinary fell 1s. to 25s. middle.

SHARE LIST OF ELECTRICAL COMPANIES.

Home Electricity Companies.

	Nom. £	Dividend. 1921.	Dividend. 1922.	Price July 3, 1923.	Rise or fall.	Yield p.c.
Brompton Ordinary	1	12	12	1⅞	—	£6 8 0
Charing Cross Ordinary ...	5	9	14	11¾	—	6 3 1
do. do. do. 4½ Pref.	5	4½	4½	4⅜	—	5 2 10
Chelsea	1	6	10	1⅝	—	5 14 3
City of London	1	14	15	2 7/16	—	6 3 0
do. do. 6 % Pref. ...	1	6	6	24/-	—	5 4 4
County of London	1	8	10	38/9	—	5 3 3
do. do. 6 % Pref. ...	1	6	6	23/9	+9d.	5 1 1
Edmundson's Ordinary	3	Nil	—	2½	—	Nil
do. 6 % Pref. ...	5	12/-	—	4⅝	—	6 8 0
Kensington Ordinary	5	10	12	9½	—	6 6 4
London Electric	3	4	10	4 7/16	+ ½	6 16 0
do. do. 6 % Pref. ...	5	6	6	5⅜	—	5 11 7
Metropolitan	1	7	8½	29/-	—	5 17 4
do. 4½ % Pref.	1	4½	4½	17/6xd	—	5 1 5
Newcastle-on-Tyne Ordinary ...	1	Nil	2½	⅞	—	2 17 2
do. 5 % Pref. ...	1	5	5	16/3	—	6 3 1
do. 7 % Pref. ...	1	7	7	24/-	—	5 16 8
Notting Hill, 6 per cent. Pref....	10	6	6	9½xd	+ ½	6 9 9
North Met. Elec., 6 % Pref. ...	1	6	6	29/-	—	5 9 1
Urban Ordinary	3	Nil	—	2½	—	Nil
do. 5 % Pref. ...	5	2½	5	4½	—	5 11 1
St. James' and Pall Mall ...	5	12	14½	11⅛	—	6 2 1
South London	1	7	10	1 1/16	—	5 10 4
South Metropolitan Pref. ...	1	7	7	1⅛	—	5 12 0
Westminster Ordinary	5	10	12	9⅛	—	6 1 6
Whitehall Elec. Invst., 7½ % Pf.	1	7½	7½	20/-	—	7 10 0

Home Rails.

Central London Ord. Assented	Stock	4	4	7¼	—	5 8 1
Metropolitan	,,	2½	3½	68½	—2½	5 2 2
do. District	,,	1	3	52	—½	5 15 5
Underground Electric Ordinary	10	Nil	Nil	2⅝	—	Nil
do. do. "A" ...	1	Nil	Nil	8/6	—	Nil
do. do. Income	Stock	4	5	96	—	*5 4 1

Telegraphs and Telephones

Anglo-Am. Tel. Pref.	Stock	6	6	106	—	5 13 3
do. Def.	,,	1½	34/6	28⅜	—	6 8 4
Chile Telephone	5	6	6	6½	—	4 18 0
Cuba Sub. Ord.	10	7	7	7½	—	9 6 8
Eastern Extension	10	10	10	17⅞	— ⅛	5 12 8
Eastern Tel. Ord....	Stock	10	10	180	—5½	5 11 1
Globe Tel. and T. Ord.	10	10	10	17⅝xd	— ⅜	5 12 8
do. do. Pref.... ...	10	6	6	11⅛xd	—	5 3 2
Great Northern Tel.	10	24	22	27½	— ½	8 0 0
Indo-European	25	10	7	30½	—	5 14 9
Marconi	1	25	15	2 7/16	+ ¼	6 9 10
Oriental Telephone Ord. ...	1	12	12	2 1/16	—	*4 1 8
United R. Plate Tel.	5	8	8	6⅛	— ½	*5 16 4
West India and Panama ...	10	Nil	Nil	1/6	—	Nil
Western Telegraph	10	10	10	17⅞	— ⅜	*5 12 8

Home and Foreign Trams, &c.

Anglo-Arg. Trams. First Pref.	5	5½	12½	8⅛xd	—	8 9 0
do. do. 2nd Pref.	5	Nil	5½	2 1/16xd	— 1/16	9 15 6
do. do. 5 % Deb.	Stock	5	5	79½	—	6 5 9
British Electric Traction Ord.	,,	4½	5	74½xd	+1½	6 14 5
do. do. 6 % Pref.	,,	6	6	98xd	—	6 2 5
Brazil Tractions...	100	Nil	4	51	—	7 16 10
Brit. Columbia Elec. Rly. Pcc.	Stock	5	5	89½	—	5 11 9
do. do. Preferred	,,	5	96/-	79½xd	+ ⅜	*6 0 6
do. do. Deferred	,,	8	127/-	98½xd	+ ⅜	*7 1 8
do. do. Deb. ...	,,	4½	4½	79	—2	5 7 7
Lond. & Sub. Trac. 5 % Pref.	1	3½	5	10/-	— 6d.	10 0 0
London United Tram. Deb. ...	Stock	4	4	64½xd	—	6 4 0
Mexico Tram. 5 % Bonds ...	—	Nil	Nil	31½	— 4	6 2 8
do. 6 % Bonds ...	—	Nil	Nil	60½	—	Nil
Mexican Light Common ...	100	Nil	Nil	32½	—1	Nil
do. Pref.	100	Nil	Nil	60½	—6	Nil
do. 1st Bonds ...	—	Nil	5	70½xd	—	7 1 10

Manufacturing Companies

Babcock & Wilcox	1	15	20	2 3/16	—	4 11 4
British Aluminium Ord. ...	1	10	5	20/9	—	4 16 5
British Insulated Ord.	1	15	15	2 7/16	—	6 3 0
Callenders...	1	15	15	2½	+ 1/16	6 0 0
do. 6% Pref.	1	6½	6½	23/9xd	+6d.	5 9 5
Crompton Ord.	1	10	5	⅝	—	8 0 0
Edison-Swan	1	10	Nil	4/6	+6d.	Nil
do. do. 5 % Deb.	Stock	5	5	65xd	—	7 13 10
Electric Construction	1	10	10	1 1/16	—	6 16 1
English Electric	1	8	5	18/6	—	5 8 0
do. do. Pref.	1	6	6	20/-	—	6 0 0
Gen. Elec. Pref.	1	6½	6½	23/9xd	—	5 9 5
do. Ord.	1	10	5	20/9	—	4 16 5
Henley	1	15	15	2 7/16	—	6 3 0
do. 4½ Pref.	5	4½	4½	4½	—	5 0 0
India-Rubber	1	10	—	⅛	—	—
Met.-Vickers Pref.	2	8	8	9½	—	6 8 0
Siemens Ord.	1	10	10	17/6	—	Nil
Telegraph Con.	12	20	20	25½	—	*4 16 0

* Dividends paid free of Income Tax.

INTER-IMPERIAL TRADE.—II.

By W. G. NEWBERRY, A.M.I.E.E.

IN the previous article on this subject it was suggested that by imposing protective duties to foster the local production of manufactured articles, the Dominions are retarding their development along natural lines and injuring the United Kingdom—their best customer.

This is illustrated by figures published by the Board of Trade. During the three years, 1919, 1920, and 1921, the average annual value of the imports of food and raw materials into the United Kingdom from Australia, Canada, and New Zealand amounted to £218,000,000 sterling, whilst the average annual value of manufactured articles exported by the United Kingdom to the same three Dominions was £79,000,000 during the same three years. Thus, for every pound's worth of manufactured products sold to these Dominions by the United Kingdom, she bought nearly three pounds' worth of food and raw materials.

The Board of Trade statistics also show that roughly 40 per cent. of the exports of the United Kingdom go to the Empire and 60 per cent. to foreign countries.

Clearly our capacity as buyers depends on our success as sellers, and it would appear from the above figures that for every pound's worth of goods that the Dominions make for themselves, they lose the United Kingdom's orders for three pounds' worth of food and raw materials.

An interesting sidelight was thrown quite recently on this subject by an announcement in the daily Press that Australian exporters had lost an order for canned meat for the British Army, to the Argentine, the Australian tender being £10,000 higher than that from the Argentine. (See *Daily Mail* of May 16th.)

Is it not more than possible that had Australia devoted to the production of meat those energies which she has expended in endeavouring to cultivate local manufacture, she might have been able to present a more attractive offer to the British War Office, with resulting benefit, not only to her stock farmers, but also to the packing and the other industries connected with the canned meat trade which must necessarily be carried on locally?

At any rate, it would appear that whilst the imposition of a duty large enough to protect the local manufacture of a product may be an advantage to those individuals engaged in the manufacture of that product, it is injurious to the great majority of the Dominion population by reducing the capacity to buy of their best customer, and by raising the price of imports to the Dominion population, thus increasing the cost of living and making it more difficult for them to compete when selling in the world's markets those products which form their staple industries.

There appears to be grave danger of Dominion duties being imposed without due consideration being given to their inter-Imperial effects.

Without desiring in any way to suggest interference with the right of self-government enjoyed by the Dominions, the writer believes that the whole Empire would be benefited if such questions could be referred by mutual consent to a central conference composed of representatives of:—

(1) The United Kingdom Government.
(2) The Dominion Governments.
(3) The Home consumers.
(4) The Dominion consumers.
(5) The Home manufacturers.
(6) The Dominion manufacturers.

Such a conference would be capable of considering the proposed duty from every point of view, and there would be no danger of the "wire pulling" by a few interested parties, which, it is feared, is a feature of the present conditions.

It was also pointed out in the preceding article that in spite of the nominal preferential duties granted to the United Kingdom, the Dominions, by basing their duties on the fair home market value, are discriminating unfairly against the British exporter and favouring the importation of goods made in countries having cheap labour and a low standard of living.

The Dominions surely do not wish to make the British exporter pay more on a British product than the foreigner pays on an exactly similar product, when selling it at the same price in the Dominion as that quoted by the foreign manufacturer. Yet that is what is happening under the present conditions.

This anomaly would almost entirely disappear if all duties were based on weight. Although British goods generally weigh more than foreign, it is recognised that this is due to more liberal design, and therefore superior quality, and this consideration, together with the preference in duty already conceded, would, in most cases, compensate for the increased duty corresponding with the greater weight.

It may be pointed out as an incidental recommendation that a weight basis would appear to be far simpler to operate than the present basis of home market value.

It is recognised that, if a weight basis were adopted, dumping duties would disappear; but, if a Dominion decides to protect a particular industry, such protection should be obtained by increasing the ordinary duty to the required amount rather than by adopting additional duties, such as the existing dumping duties, which, as has been demonstrated, discriminate so unjustly against the British exporter.

The third difficulty indicated was the transference overseas of the Registered Offices of Public Utility and other companies in order to escape "double income tax," with the result that the British manufacturer loses contact with his customers, with grave danger of eventually losing their business.

The writer does not profess to be able to detail the remedy for this evil, but it cannot be stated too emphatically that to drive such companies abroad involves serious loss both to the British manufacturer and to the British revenue. Once the evil is appreciated, the Revenue Department can no doubt devise a system which will make it possible for such companies to remain here without injustice to their overseas shareholders.

A reasonable solution would appear to be to tax such companies, as companies, only in the countries where they operate. United Kingdom shareholders would then receive dividends untaxed by the British Revenue Department in the same way that they do when the company's office has been transferred overseas. The British tax would be collected on the incomes of the individual shareholders.

The Austrian Siemens-Schuckert Co.—The report states that orders were abundant in the first half of 1922, but an industrial crisis manifested itself towards the end of the year. The crisis has become aggravated in the present year owing to the keen competition of Germany, favoured by the fall in the mark. In addition, certain orders which would otherwise have been placed in Austria had been allotted by various countries to German firms by way of deliveries on reparation account. The accounts show net profits of 2,071.5 millions of crowns, and the dividend is at the rate of 1,000 crowns per share.

German Lamp Taxes.—The Taxation Committee of the Reichstag, revising the taxes on lighting appliances, has approved the imposition of a tax at the rate of 20 per cent. of the invoice value to customers on metal-filament lamps of over 20 volts, and on such lamps for pressures of less than 20 volts in so far as the consumption of power exceeds 15 watts. Mercury-vapour lamps are also subject to this invoice tax, which is substituted for the tax on the turnover.

PATENTS AND PATENTEES.

(Communicated.)

The writer was much interested in the leaderette and article on inventions in a recent issue of the Electrical Review, and as he himself is an inventor and patentee who has failed to make a penny by his inventions, he considers he is in a position to give expert advice to other inventors; his claim in this respect is somewhat similar to that of the slum lady who resented the advice of the unmarried district nurse on the rearing of children, since she herself "had buried five."

Well, first of all, let it be known that there is neither honour nor glory attached to merely being a patentee. Patents are supposed to be granted to inventors with the intention of protecting their interests, and so securing to them some monetary return for ideas which may be used for the benefit of their fellow men. They do not constitute a guarantee of usefulness.

Here is the stumbling-block which often causes such bitter disappointment, for, as the law stands, patents are frequently granted for inventions of no earthly value to anyone. Some kind of advisory body of experts is required which can weigh up a patent application, and advise applicants as to whether or not they should proceed. The difficulties are obviously very great, for such advice, even if sound, would frequently be ignored. This is particularly true in the case of inventors who are attempting something they do not properly understand, and who are blind to everything but the possibility of making large sums of money.

The writer has frequently had the most hopeless engineering propositions put before him by inventors with no knowledge of mechanics or scientific matters. Generally, it may be said that inventors have little chance of successfully producing an invention for an industry with which they are not well acquainted.

As an example of what is meant, the writer will quote the case of a patent specification upon which he was asked to report during the war. The inventor, a hairdresser, had obtained a British patent for an airship, and was desirous of getting the invention taken up by manufacturers. The main idea consisted of the method of elevating the vessel and propelling it forward. Above the car was to be fixed a large plane, terminating forward in a downwardly-curved nose piece. Underneath the plane a number of paddle-wheel motor-driven fans were to be placed, so as to blow upwards and forward into the nose piece. The fans were to be arranged vertically and close together, and were to be cased in, so as to leave only their lower edges exposed. A special claim was made that the draught caused by one fan would help the next, and so reduce the power required.

The writer turned the proposal down as kindly as possible, but he has little doubt but that the inventor has since gone through life with the bitter thought that it was only because he was a poor man that he could not get his invention put into practice.

To advise such an inventor is very difficult, for the natural course is to suspect professional jealousy, but it is a crying shame that such patents should be granted. If the Patent Office is prepared to take large sums from inventors, it should do something towards assuring them that the patent it issues is not merely a foolish document.

It is not suggested that the Patent Office should have the power of refusing to grant a patent on the ground that its officials do not consider the idea practicable, but merely that they should tender such advice, leaving it to the applicant to persist, if he wishes, for, after all, he has to uphold his patent rights in any case.

It is well known that the British Patent Office has issued many patents for perpetual-motion machines, but it is not so generally known that the United States Office requires inventors of perpetual motors to produce working models, an embarrassing stipulation that has saved much time and money.

To an inventor who is amenable to reason, the writer would suggest the following:—

Having made your invention, consider seriously whether it has sufficient commercial value to bring in at least the £20 to £50 the patent is liable to cost you. If it has not, abandon the idea.

Is the idea novel? It is quite possible that it is novel to you while being well known to others; in which case a patent is almost hopeless. The writer remembers a man who had honestly invented a very poor example of a spring hinge, but was perfectly satisfied that there was nothing of the kind on the market merely because he had been unable to get one at the local ironmonger's. It is well to have a thorough search made for novelty before filing an application. A good patent agent will do this, or the inventor can do it for himself. If he lives near London he can call at the Patent Office in Chancery Lane, and examine the files of previous patents. Abstracts are arranged in a systematic way, and complete specifications can be seen, if desired. The search should extend over a period of 50 years' patents.

Even if a prior invention of somewhat similar nature is discovered, it does not follow that the newer idea is hopeless, as it may be meant to apply it in a different manner; but the inventor should proceed carefully.

An inventor should not allow his commercial judgment to be warped by the fact that he is an inventor. It is of little use taking out a patent for an article than can only be put on the market at a price much above something else that serves the purpose quite well. This is especially true of domestic inventions. Thus, every engineer will be aware of the time- and gas-saving properties of tubular kettles, but what chance has such a kettle at 12s. 6d. against an ordinary one at 1s. 6d., although the more expensive one may be a better proposition? The womenfolk buy the kettles, and they are not so impressed by the possibilities of ultimate saving.

Then, again, it is useless to take out patents for articles that can be imitated without any real infringement. Telephones, for example: any maker can turn out perfectly satisfactory instruments, regardless of patents. Typewriters represent a class of article where patents are almost useless.

Of course, if an inventor is already in such a line, he may bring out a special design and so secure a portion of the trade, but it will not be because of his patent. If he is not in the line he might just as well save his time and money, for there would be no real necessity for anyone to pay him a penny for his invention.

Patent brush-holders for dynamos and motors are another example of foolish waste of money. In the early days every maker had his patent design, but it is doubtful if there is a case on record of any maker having paid a royalty to any other inventor; he simply sat down and designed his own.

In looking over the pages of a technical journal, it is astonishing to note the number of patented articles, but in many cases it is difficult to imagine how the patent can give any real protection, or bring business that would not be obtained in any case.

Finally, it may be said that in general money can only be made through a patent if it covers some special want or line for which a demand may be created, and which cannot be met without it.

THE TRAMWAYS AND LIGHT RAILWAYS ASSOCIATION.—II.

ANNUAL CONGRESS.

On the first morning of the Congress, following the civic reception at the Mumbles Pier and after the annual general meeting, the following paper was read and discussed :—

Tramways : And Some of To-day's Problems.

By A. W. A. Chivers.—(*Abstract*).

The following particulars, extracted from the return issued by the Ministry of Transport for 1921/22, show that tramways in Great Britain (particulars for Irish undertakings are no longer included in the return) play no mean part in providing travelling facilities.

Statement A.

Route miles	2,579
Capital expenditure	£85,908,610
Passengers	4,256,268,692
Car miles	332,079,865
Gross receipts	£32,523,339
Working expenditure	£26,835,292
*Net receipts	£5,668,047
Do. per cent. of capital expenditure	6.6 per cent.

Taken generally, tramways have not proved remunerative. On the above capital expenditure the net receipts amounted to only 6.6 per cent. While some undertakings collectively contributed £174,738 in relief of rates, others were rate-aided to the extent of £371,303, notwithstanding the fact that the income was augmented by £559,194 received from sources other than tramway operation for that year.

In considering this result it should be borne in mind that 1921-22 was in many districts a record year. The poor results obtained since are due largely to general trade depression, but, in addition, omnibus competition has had its effect.

Photo by] The Tramways and Light Railways Association at Swansea. [*Chapman.*

Being fettered with many statutory obligations of an onerous character, it is not surprising that tramways, considered generally, are not very remunerative, and unfair and unnecessary omnibus competition, which is rapidly on the increase, is likely to become a serious menace. Strong and energetic action is urgently needed to relieve tramways of their unfair burdens and obligations, and to protect them against ever-increasing unfair competition. Consider what the approximate effect of only two of those unfair burdens (road improvements, and paving and foundation) had on the financial result for 1921-22, as given in statement A.

Of the total capital expenditure, £3,585,211 was in respect of road improvements, and £37,398,998 was spent on permanent way. Of the latter amount the proportion spent in providing paving and foundations (unnecessary for the tramways) was probably of the order of 35 per cent., or, say, £13,000,000. Of the total working expenses £2,698,474 was spent on permanent-way maintenance, and of the latter probably 60 per cent., or, say, £1,619,000, was in respect of paving.

If the working results in statement A were recast, making adjustments for these items, the percentage of net receipts to capital expenditure would be increased to 10.5 per cent. against the actual return of 6.6 per cent. It would probably have enabled capital charges to be met in many cases where they were not, and have allowed better provision to be made for depreciation and renewals.

The introduction during recent years of improved methods for the construction, reconstruction, and maintenance of the track should result in reduced costs. Foundations in many cases are no longer laid to meet the requirements of the tramway traffic, but the requirements of ordinary and extraordinary vehicular traffic.

Welding appliances have permitted tracks to be kept in a much better state of maintenance at less cost than was possible some years back, having regard to the rates of pay and prices of materials. Much economy and prolonged life of rail is claimed for the process whereby the rail-head may be hardened *in situ*. It is an attractive proposition, but the problem is to adopt those methods best suited for the particular circumstances of the case. If there is any one problem of more importance than others requiring solution, I think it is how to design better and more comfortable cars. This matter is being forced upon us by the improvements being made in omnibuses, and in the condition of the roads on which they operate—often at considerable expense to the owners of tramways.

Our fare and ticket systems are complex compared with those in use in some other countries. Ticket-issuing and change-giving machines are familiar to you, and, I believe, have been adopted in a few special cases where the traffic is not heavy. So far they do not appear to meet all the requirements connected with fare collection in this country.

Apart from the use of top-deck covers, the chief improvement in body design during recent years is perhaps the more general adoption of vestibule and semi-vestibule ends, which at very considerable additional cost give more comfort to the motormen and conductors, and the car a better appearance, but little has been done to provide more comfortable seats for the passengers. The average speed of many tramcars is miserably low.

Modern motors and brake equipments possess the necessary characteristics for maintaining high average speeds. In many cases the substitution of ventilated for old-type motors can be justified by reason of the savings to be effected in reducing maintenance costs. Mr. Humphries, engineer to the Black Country Tramways, furnished the following comparative costs for motor maintenance, which indicate his experience in connection with this matter. The figures cover a period of nineteen months :—

Statement B.

	Ventilated motor.	Old type motor.
Number of cars equipped ...	27	8
Number of motors	54	16
Maintenance costs	£196	£623
Average cost per motor ...	£3.69	£38.9
Average miles run per car ...	33,800	33,800

Mr. Pilcher, of Edinburgh, is experimenting with a new form of rubber-packed wheel intended to absorb some of the shock caused by the metallic contact made between the wheel and the rail. I am not sure that many tramway engineers have not made the mistake of regarding some of the tramcar maintenance work as calling for only semi-skilled labour, particularly truck overhauling, which is often reflected in noisy cars, and there is in many cases, where electricity is generated by the tramway owners by means of obsolete plant, much scope for effecting economies.

An extension of the period during which increased fare-charging powers are authorised under the Tramways (Temporary Increase of Charges) Act, 1920, is becoming urgent. It is a question whether action should not be taken to obtain by legislation powers more permanent in character than those con-

*Before payment of interest and sinking fund charges and before providing for reserve and renewals.

tained in this Act. Unless something is done to obtain more permanent powers the indications are that many undertakings will suffer financially. Unfair competition by omnibuses appears to be intimately bound up with competition between omnibuses themselves. In this connection extracts from evidence given before the Royal Commission on London Government by Sir Henry Maybury, Director-General of Roads Ministry of Transport, are given in Appendix I.

Unemployment insurance is being explored by a Joint Committee representing the Municipal Tramways Association, and this Association, with the object of seeing whether it is practicable to formulate a scheme of unemployment insurance for the tramway industry, or as an alternative, to obtain exemption certificates for employés, and so obtain exemption from the Government's present scheme.

The erection of aerials for radio work in close proximity to tramway overhead work has recently been receiving attention by the Council of this Association. The obligation of tramway owners to erect guard wires, and the liability for accidents due to fallen aerial wires coming into contact with the trolley wire, are of importance, and it is hoped that the Ministry of Transport, whose attention has been drawn to the matter, will be able to take such action as will result in adequate protection in this matter being given to tramway owners.

While tramway owners are fettered with all sorts of onerous obligations in operating their tramways, they are also in a difficulty if they wish to cease to operate them. Given a fair chance, no form of road transport has yet been evolved that can successfully compete with tramways for the conveyance of large masses of people. What we need is fair play for tramways.

APPENDIX I.

Sir H. MAYBURY: I think that someone should have the power to say where competitive services should run, and whether they should run where they are unnecessary, which is happening occasionally. We get a very good omnibus service on a road; then we get a certain amount of piracy; people run just at the peak of the load and take the cream of the traffic, thus spoiling the route, and unnecessarily wearing out the roads. There ought to be some power in some body to say that proper facilities shall be provided, but there shall be no unnecessary competition. . . . We have had to do it in a way in the country where we have had competing services. When local authorities have refused to license unnecessary services we have had to support them in their action upon appeal.

Sir ALBERT GRAY: When a new line of omnibuses is started is there power to make it a condition that they shall not use certain streets?—We have the power under Section 7, Subsection 4. . . .

That is if the street is unfitted for it?—Yes. It is for the safety of the public.

It does not quite cover the case you were putting just now?—No. . . .

Discussion.

Mr. W. G. VERDON-SMITH opened the discussion by regretting that the author had concluded his paper with a reference to the abandonment of tramways. He looked forward to legislation at some time which would put the matter straight, but on such an occasion other matters would have to be dealt with, especially of continuous service and electrolysis. Against motor omnibus competition, tramway companies had no redress at all. The problem did not affect their municipal friends so severely, because in most cases the local authority was also the licensing authority, and even where appeals to the Ministry of Transport were made against the decisions of local authorities the tramway companies had no opportunity of being represented as they had no *locus standi* at all. That state of affairs called for redress.

Mr. EMILE GARCKE thought it desirable to avoid a wrong impression that might get into the minds of the general public with regard to the abandonment of tramways. Tramway contractors and managers as a body were not contemplating any general policy of the abandonment of tramways, but in view of modern developments, railless trolley vehicles, motor omnibuses, and so on, it had become evident that in respect of some unremunerative portions of large undertakings, which could be more profitably worked in ways other than by tramways, they should be relieved of the unnecessary obligations to maintain such tracks.

Mr. A. H. WALTON (London) said they had heard so much about the good old hardy annual, the motor omnibus, that one would like to see something done. Why could not they as an association, do something?

COUNCILLOR MORRIS MANCOR (Edinburgh) said that dense traffic in large areas demanded comparatively large seating capacity, and when he saw tramways in that condition he realised that they could be made to pay. Mr. Chivers's calculation of weight per passenger carried was made with the car full, but what percentage of the day was the car absolutely filled? In Edinburgh they were lucky to get anything like five hours. They had taken steps to introduce a light-weight car for 60 passengers, weighing less than nine tons, but he was sorry they did not adopt some single-deck cars. They would have to consider whether they could not be a little kinder to their track than in the past. They had hitherto punished it severely, and costs were high and renewals excessive. How were they going to deal with the traffic and put light-weight equipment on the rail?

Mr. H. R. HOGG (London) complained with regard to track maintenance, that whenever a municipality altered the level of a roadway the tramway company, without being consulted, was forced to alter the level of its track.

Mr. C. J. SPENCER, O.B.E. (London), said that tramways had not been a successful financial speculation, but surely they ought to be a safe investment. They were undoubtedly a great public utility for they carried in the year under review 4,000 million passengers. He sometimes felt that the Government, and especially some of the departments, were forgetting the useful work tramways were doing. Committees were set up to consider other forms of transport, but there was a shyness when the Government departments were asked to consider the interests of tramways.

Mr. C. D. STANLEY (London) said the Government might wield the necessary authority to regulate the passenger service, or the local authority might do it, but there were two essential qualifications: First, they must be impartial, and secondly, the personnel should represent actual knowledge and experience of the working and management of a public transport service.

Mr. W. THOM (Stoke) agreed as to the very objectionable obligation to maintain track paving, but was there any reason why the electric car business should be less responsible for maintaining good paving than the horse traffic?

Mr. C. J. JEWELL (Norwich) thought that tramway companies were badly placed in respect of power generation; they had to scrap their plant if they took bulk supplies, and by doing that they were simply scrapping their capital with no chance of getting it back. That was the reason why he had hesitated to go in for a bulk supply, and he also hesitated about installing turbines, but turbo plant had brought the costs down very considerably. It should be borne in mind that this was probably the fly in the ointment.

Mr. A. DIMMACK (Stoke) declared that beyond a first-class railway train they could not find a more comfortable vehicle to travel in than a tramcar, even without cushioned seats. On the question of economical plant, he had the privilege during the war of installing new plant which had the effect of reducing the coal consumption by one half, and a large amount of electricity was generated at pre-war cost. Coal was then double the price. It was a municipal station, and the interest and sinking fund charges could be paid on the money saved, and something left to put into the bank. It turned a few hundreds of pounds profit into profits of thousands.

Mr. R. H. HUMPHRIES (Smethwick) thought the useful slogan that could be sounded at tramways conferences was "economy." If they could keep their working costs down and provide a good service and efficient running, they could keep their end up against competition. They, in the Black Country, had done a great deal in that way in spite of increased cost of labour and material. They had increased the life of the trolley wheel, they had found white metal that would give them about three times the life of the old metal, bearing blocks that would give three times the life of the old grade iron, and a lubricating oil that would last twelve months in the axle box without attention. And it was in that direction that "every mickle made a muckle."

Mr. J. BECKETT (London) said that the cost of living had not varied more than 14 points in 15 months, and the Chancellor of the Exchequer said quite recently that he did not look forward to any reduction of prices, and that if it came it would be disastrous for any Chancellor to budget. And so he (Mr. Beckett) thought they would have to recognise that they were very near the stabilised figure so far as prices were concerned. There was a manifest duty on the part of the State to relieve tramway authorities, whether municipal or company, from a part of the burden of road repairs.

Electric Tramway Rolling Stock.

The second day's proceedings commenced with a paper on the above subject, by Mr. W. E. Ireland, in which it was pointed out that there had recently been a revival of the desire to produce rolling stock of a lower weight than had been the vogue. The author's object was, therefore, to show that they could not altogether lighten their cars without regard to the fact that they were carrying a big top deck load. That was more especially necessary having regard to the fact that speeds were going up. One could wish that speeds of cars were limited by Ministry of Transport regulations. They all knew that there were regulations, and also that motorists were supposed to follow them, but they did not do so. There was also the human frailty factor to take into account, though it did not do, he thought, to see a car on the road with all the weight taken out of the bottom of it with something like three tons of people 10 feet from the ground. That was really the object of the first part of the paper. The second part related to the single-deck car, which was quite a different proposition. The structure was very light because the stresses were so limited, and the centre of gravity very much lower apart from the roof cover. That brought them then to the

much debated question of coupling or otherwise. If they wanted to get big seating capacity with single-deck cars, the length of the car being limited by curves, then it seemed to him that they had to resort to coupling, mechanically or electrically, or both.

In a single-deck coupled car in which the weight of all the members would be reduced to a minimum, the body would be supported directly on the axle-boxes through long laminated springs, with spiral springs between the links and the underframe, thus dispensing with the usual form of truck. A light steel framing supported directly on the axle boxes through suitable springs would carry the brake gear; the motors would be suspended to the car underframe, and the drive to the axles would be by a suitable silent chain with the axles forged hollow, thus reducing the unsprung weights. The weight of each car constructed to this design was calculated not to exceed 9,520 lb. or, say, 244 lb. per seat. The cars, if used in pairs, would be electrically coupled, and each would collect power for its own motors by its own trolley. Small master controllers would be carried on each platform actuating a single motor-driven controller on each car, and provision would be made for the automatic application of the brake gear in the event of the cars parting, by means of clutch gear.

The general advantages which could be realised by the adoption of cars of this design were: (*a*) Greater loading and unloading capacity to serve rush traffic, owing to the number of entrances and exits provided; (*b*) reduction in energy consumption and maintenance costs; and (*c*) lower axle loads, tending to longer life of tracks, tires, &c.

Then the last part of the paper dealt with the much debated tire question, and he carried out tests to prove what wear was due to brake block action. He had come to the conclusion that brake block action in its effect on the tire was practically negligible, and that he had endeavoured to show by giving particulars of the tests he had carried out.

What follows is an abstract of the remainder of the paper: 382 miles of tire periphery were rubbed by the brake-blocks at full load and double full load, equivalent to all the braking likely to be met with during 5,000 miles of travel in service. Not only did no measurable wear take place, but centre-punch marks, as well as scribed lines, were still quite plain. The results show that brake-block action at any speed above, say, half a mile an hour (about the maximum cutting speed) has no wearing effect on the tires, and the test appears to have eliminated any question as to the effect of brake-block action tending to influence the shape of the tire profile. There remain two questions:—(1) Does the tire assume its ultimate shape entirely by the detrusion of the metal by the imposition of dead load and rolling? and/or (2) by a combination of rolling under dead load and the mechanical effort between the tire and rail in moving the load?

In considering (2), loss of thickness may result from wear by abrasion to some extent, if rail and tire are regarded as a rack and pinion having infinite teeth. Under the heavy loads imposed some of the teeth in both rack and pinion may be broken off and lost, or alternatively squeezed flat and detruded from the surface to the outer edge of the tire.

At the conference in London three years ago, it was suggested that this test could only be regarded as being a laboratory test; consequently the investigation was carried a stage further. A single truck car was arranged with one of its axles with the standard brake gear, the brake-shoes applied to the tire periphery in the usual way; on the other axle the braking was transferred from the road wheels to supplementary wheels fitted with tires rolled from the same material as the four road wheels.

There were accordingly six wheels on the truck; two road wheels on one axle were subjected to rolling and brake loads, two road wheels on the other were subjected to rolling load only, and two supplementary wheels to brake load only. All the tires were reduced at a closely uniform rate. The supplementary tires were reduced at the rate of about three-thousandths of an inch for each 10,000 miles run.

From the results I formed the opinion that for tramway work the amount of material worn from tires by brake-shoe action need not be taken into account when investigating the best material to be used for the manufacture of tires.

Experiments were also made to determine the ability of tire flanges to carry the wheels over junctions in special work by way of ramps cast in the crossings. Railhead parts of crossings are not free from battering by the wheel treads, whereas if the ramp performed its proper function, and the tire flange were able to carry the load across the junction, the railhead could not be damaged by the tread of the tire, simply because the two could never come into contact.

To ascertain the number of times a tire would have to be run over a junction in special work to reduce the height of the flange from its original dimension of 9/16th in. to the least depth of the groove in the crossing, a crossing whose groove was half an inch at its least depth was inserted in a length of rail on a straight road, the opposite rail remaining as laid. A single truck car was run to and fro over the crossing; the flanges of two wheels making contact with the top of the ramp each time it was traversed were flattened, and the steel detruded outwards, but none was actually abraded, although the brake-shoes were applied each time the car traversed the ramp.

To learn the time it would take to produce a similar result under actual service conditions, a new set of tires were fitted, with 9/16 in. depth of flange. Special brake-blocks with deep grooves were used, so that the flanges could never be in contact with the blocks.

These tests leave the impression that if ramps in special work have the effect of reducing the flange depth, and cannot perform the function they were intended to fulfil, they would be better left out, as no more battering of the railhead part of special work would be experienced than is the case at present.

The Standard Specification No. 101, issued by the British Engineering Standards Association, calls for an inclination of 1 in 20, and to test the effect of running this shaped tire under London conditions, tires machined to this inclination were put into service. There was a rapid initial increase in the angle of inclination of the tire tread, and the rate of change in steepness between the three points of measurement differed until about 5,000 miles had been run, when the tire had assumed its typical shape, which remained practically constant throughout the remainder of the test up to 16,000 miles. Similar readings were taken on tires whose first inclination was 1 in 10, with the result that the tires reached exactly the same typical shape, but in a shorter time. Generally the rate of wear of each tire may be divided into two parts: First, that accruing during the time the change in inclination is taking place and, secondly, during the time when there is no appreciable change in inclination.

The percentage difference in the rate of wear for each eighth of an inch approximates to as much as 10 per cent., *i.e.*, there is approximately 10 per cent. more miles run per unit of thickness during the later part of a tire's life than the earlier, owing to the fact that during the time the tire is changing its profile the rate of detrusion is a maximum, because the area of contact varies from the minimum to the maximum.

I have accumulated a large amount of data relating to this matter, and the conclusions come to are:—

(1) That the load per square inch on the area of contact presented by a tire flange on the ramp in special track work is too great to permit of the flange carrying the tread clear of the railhead when traversing crossings, &c.

(2) That brake-block action in its effect on tire wear is negligible.

(3) That the life of a tire in terms of radial thickness is governed by (*a*) its width; (*b*) the load per square inch on the area of contact; (*c*) the elastic limit of the steel from which it is made; that is to say, a tire whose tensile strength is 100 tons per sq. in., with an elastic limit of 50 tons, would give the same results as a tire of 70 tons per sq. in. tensile strength, whose elastic limit was also 50 tons.

(4) That normalising, heat treating, and tempering are essential to secure uniformity of structure in the steel.

(5) That to secure tires on each axle of closely uniform hardness, they should be matched by their Brinell numbers; each tire should be passed through a suitable hardness testing machine, and the hardness number stamped on the tire.

(6) That the initial angle of inclination of the tread of a tire should approximate as nearly as possible to its "typical shape."

Discussion.

Mr. A. W. A. CHIVERS (London), in opening the discussion, said that rolling stock was to his mind one of their most important problems. When he compared even the favourable figure given for the L.C.C. car with some of the weights of cars which were built in the early days of electric traction, he found that even the L.C.C. weight per seat was fairly high.

Mr. H. J. TROUGHTON (London) said, as regarded the brake-block wear on tires, that he thought that was generally borne out by certain tests which they had made, and he found a difference of wear on tires of a different class and different materials.

Mr. PILCHER (Edinburgh) said, with regard to car weights, that Mr. Ireland took for comparison double-deck cars. It would have been much more interesting if he had given them the weights for single-truck cars. He though that if he had taken the British standard he would not have found such a favourable comparison as the one he gave. There was considerable room for lightening the weights of car bodies as well. In America thousands of cars were being converted or scrapped, but they in this country sat still. He did not see how they could get a lower energy consumption with single-deck cars. Two motors were certainly required, and if they coupled cars together they required more motors, and was it seriously suggested that a car with four motors, double trucks that would seat 36 passengers each, practically 72 passengers, could be worked at a cheaper rate than the L.C.C. car, which seated 70 passengers? He did not think it could be done. One of the greatest difficulties in respect of single deck cars was street congestion, and in large cities such as London in dealing with this question they should talk about making wider roads.

Mr. R. H. HUMPHRIES (Smethwick) said the L.G.O. Co. and others, which Mr. Chivers had told them of, had done wonderful work in weight reduction, while still maintaining the necessary strength against stresses, and it would have

been a good thing for tramways had they had to come up against an authority similar to that which the L.G.O. Co. had had to come up against to get its licences. Improved acceleration and de-acceleration; reduced energy consumption, and breaking stresses; increased safety on descending gradients; and reduced rail, gear, and pinion wear were some of the points they would get if they could get their weights down.

The discussion was continued by Mr. R. G. CUNLIFFE (Manchester) Mr. R. B. HOLT (London), Mr. C. J. SPENCER, O.B.E. (London), Mr. R. J. HAWLEY (London), who expressed the view that the future of the tramcar was a sort of rural train, Mr. A. H. JACKSON, who said the ideal car should be a four-wheeled vehicle and each should have a separate motor, and Mr. R. H. HOGG (London). Mr. W. JOHNSTONE (Loughborough), speaking from the manufacturers' side, suggested that there should be closer association and collaboration between tramway managers and manufacturers in the design and equipment of cars. At present the manufacturers were not brought in at a sufficient early stage.

CEYLON'S ELECTRICAL IMPORTS.

THE following table shows the value of Ceylon's imports of electrical and allied material during the past year. That of electrical material, including machinery, totalled just over £800,000 in 1922 as compared with about £550,000 in 1921. It is possible to compare only the totals for the two years because there was no detailed classification until after June, 1921. The figures given in column 1 are those for the last six months of 1921 :—

	Last 6 months of 1921. Rupees.	1922. Rupees.
Control and switchgear.—		
Total	12,000	5,500
From United Kingdom	12,000	5,000
,, United States	—	500
Generators, alternators and dynamos.—		
Total	15,000	15,000
From United Kingdom	—	14,000
,, Germany	—	1,000
Motors.—		
Total	21,000	30,000
From United Kingdom	19,000	20,000
,, United States	1,000	9,000
Transformers and converters.—		
Total	10,000	—
Magnetos, ignition.—		
Total	—	1,000
Electric wires and cables (insulated).—		
Total	61,000	163,000
From United Kingdom	58,000	155,000
,, United States	—	4,000
Telegraph and telephone instruments and apparatus.—		
Total	13,000	88,000
From United Kingdom	9,000	84,000
,, United States	3,000	4,000
Electric lighting accessories and fittings, including switches.—		
Total	36,000	125,000
From United Kingdom	32,000	92,000
,, Germany	—	8,000
,, United States	2,000	13,000
Electrical goods and apparatus not elsewhere specified.—		
Total	59,000	191,000
From United Kingdom	33,000	59,000
,, Australia	—	73,000
,, India	6,000	21,000
,, Italy	6,000	8,000
,, United States	11,000	21,000
Electrical machinery not elsewhere specified.—		
Total	53,000	183,000
From United Kingdom	36,000	149,000
,, Germany	—	7,000
,, United States	1,000	21,000
,, Italy	13,000	—
Machinery belting, leather.—		
Total	20,000	78,000
From United Kingdom	16,000	60,000
,, India	1,000	18,000
Machinery belting, other than leather.—		
Total	59,000	298,000
From United Kingdom	59,000	288,000
,, India	—	9,000

10 rupees = £1.

GLASGOW CORPORATION TRAMWAYS.

Annual Report, 1922-23.

WE have received the twenty-ninth annual report of the Glasgow Tramways Department (manager, Mr. James Dalrymple), covering the year ended May 31st last.

This shows reductions in both receipts and expenditure. The income was £2,256,477, as compared with £2,350,753, and the working expenses amounted to £1,592,685, as against £1,804,652. The decrease in expenditure was fairly distributed over all items, but "general expenses" showed a slight increase due to expenditure on account of conferences held in the city during the year, as well as an item of £10,784 for the jubilee celebrations. The disposable surplus, after adding interest on investments, was £675,168, as compared with £549,642, but owing to the appearance of new charges the net result was a decrease in profit from £149,988 to £20,078. The depreciation fund received an additional £182,000; interest charges at £32,743 were almost three times as big as those of the previous year, and the permanent-way renewals fund was credited with £47,000 more, Against these increases, income-tax fell by about £15,000, and an item of £2,735, representing the repayment of part of a previous deficit (1919-20), disappeared.

The capital account now shows a total expenditure of £5,296,552, a sum of £650,375 having been expended during the year. The principal outlay was upon the permanent way, which absorbed £416,174; the electrical equipment of the line cost £132,861; buildings and fixtures accounted for £25,508; and a sum of £21,700 was spent in rolling stock. Against borrowings of £4,812,653, are shown repayments and sinking fund balances amounting to £3,860,560, leaving £952,093 outstanding. A table shows that a total of £1,167,305 has been contributed to the "Common Good," last year's allocation being £20,078.

The traffic returns show that the number of passengers carried was reduced from 431,372,473 to 417,169,122, and at the same time the car mileage decreased from 27,024,529 to 26,957,721, showing a decrease in the number of passengers per car-mile from 15.96 to 15.50. The largest number of passengers was carried on 1d. fares (36.62 per cent.), but the fare which produced the greatest revenue was the 1½d. one (31.99 per cent.).

The system now has 107 miles of route, and a single track mileage of 210; practically the whole of this is owned by the Corporation in perpetuity, the small remainder consisting of the lines taken over by the Clydebank Order, 1901, and the Paisley lines over which the Corporation has running powers. The rolling stock comprises 944 top covered cars, 28 uncovered cars, a converted horse car, and a training car.

The Pinkston power plant has been augmented by means of a new 10,000-kW turbo-generator, and new switchgear is being installed at the Whitevale sub-station. The department now employs a staff of 8,987 persons, including 642 women.

The "general remarks" which conclude the report refer to the celebration of the tramways' jubilee in August last; the first tramway line in Glasgow was opened for traffic in 1872 The Subway was closed for traffic in March, 1922. After negotiations the Corporation came to an arrangement with the Glasgow Subway Railway Co. whereby the Corporation assumed responsibility for any loss incurred, and the line was therefore re-opened in July last. A Provisional Order authorising the acquisition of the Subway is being promoted, and it is expected that the system will be taken over by the Corporation later in the year. In the meantime it is being operated by the directors of the company and a special committee of the Corporation. An agreement has been entered into with the Paisley District Tramways Co. regarding the purchase of its system, and a Provisional Order has been promoted for this purpose. Road widenings have been completed in Canniesburn Road and Millerston, and work in connection with road widening on the Milngavie and Coatbridge extensions is proceeding. In the near future work is to be commenced in seven other districts.

Radio Reception on Moving Vehicles.—After a long series of experiments a successful installation of radio apparatus has been made for use on the Paris-Bordeaux express, and it is probable that permanent arrangements will soon be made so that passengers will be able to hear the Eiffel Tower concerts and news messages. Two sound magnifiers were placed at each end of the smoking saloon, and in spite of the difficulties caused by the shaking and noise of the train, hearing was easy. At all points of contact with the wall and the floor, india-rubber pads were placed to diminish the effect of vibration.—*The Times.*

Indian Wireless Imports.—Notification No. 245 issued by the Government of India on May 19th, 1923, fixes the Customs duty leviable on apparatus for wireless telegraphs imported into India at the rate of 2½ per cent. *ad valorem*. The importation of such apparatus by other than a duly licensed person under the Indian Telegraph Act is prohibited except under licence from the Director-General of Posts and Telegraphs.—*Board of Trade Journal.*

THE NATIONAL PHYSICAL LABORATORY.

Report for the Year 1922.—*Abstract.*

THE annual report of the National Physical Laboratory is such a voluminous document that not more than the briefest reference to its contents can be made in the space at our disposal. It merits careful study, however, for the work done is highly important.

During the year under review, a total of 826,934 tests were made, a decrease of 98,766 on the previous year; the total number of tests made in the electrical department was 2,367, an increase of 62. A feature is the extensive use that is made of electricity and electrical devices and instruments as aids to the work in all departments. Notwithstanding the extensive additions that have been made to the buildings and equipment in recent years, the need for increased space is apparent, and in the electricity department, additional accommodation and equipment are urgently required. The report points out that unless steps can be taken shortly to remedy the present position, the Laboratory will be unable to fulfil its proper functions as a national standardising laboratory.

The work of electrical interest done during the period under review may be briefly summarised as follows: In connection with the international comparison of high-temperature scales, a comparison is being made between the scale in use in the Nela Research Laboratory of the General Electric Co., U.S.A., and that adopted by the N.P.L.; three heavy-current lamps, specially constructed for the purpose by the Nela Laboratory are being used as intermediate high-temperature standards. The work is now nearly completed and will, it is hoped, afford a comparative basis for temperature measurements up to 3,000 deg. C.

Determinations of thermal conductivity have been made of various substances, such as woods, fibres, ebonites, insulating cloths, and mica. A commencement has been made on the problem of the conditions required for the production of a wireless transmitting valve capable of a large output. Other matters under examination in the heat division include experiments on the cooling power of oils used in transformers.

The comparison of radium samples with the Laboratory standards is now part of the regular test work, and the number of such determinations has continued in the past year at about the maximum level yet reached. Radium submitted for test is usually enclosed in platinum or silver containers: examination of the container for leakage is then made, and absorption corrections are determined. An opportunity occurred during the year of testing a tube previously tested at the Bureau of Standards, Washington, and the comparison showed almost exact agreement between the results of the two laboratories. The investigation of luminous radium compounds for the Chemistry Research Board has been continued and apparatus has been provided for the examination of radioactive ores. The Radiology Division has also carried out interesting investigations relating to X-rays, including the examination of various methods of intensity measurement, and of the relative performance of Coolidge and gas X-ray bulbs when operated by coil or transformer respectively, the design of a new type of sphere-gap voltmeter, the devising of special methods for the measurement of the absorption of X-ray protective materials, the radiographic examination of materials and investigations of the structure of metallic crystals, for which a new technique has been developed. Following the recommendations of the X-Ray and Radium Protection Committee, which we outlined last year, a number of hospitals asked the Laboratory for advice on the protection of the workers, and the examination of X-ray installations has become a regular part of the work of the division.

In connection with electrical standards interesting results are recorded. The Laboratory has given assistance in the provision of a standard mutual inductance for the Japanese Electrical Standards Laboratory at Tokyo. This was made to the same design as the Laboratory standard. The two standards were found to agree within one part in 100,000. Comparisons between tests of standard cells made at the Bureau of Standards and at the Laboratory have been obtained during the past year and show agreement to one part in 100,000.

A 1-ohm coil belonging to the National Bureau of Weights and Measures, Petrograd, was tested at the Laboratory early in the year; it was afterwards compared with the Reichsanstalt standards; the two results differed by less than one part in 100,000. Four standard cells made at the Laboratory were also examined at the Reichsanstalt, and the results showed a mean difference of 25×10^{-6} volt from the N.P.L. value.

In recent measurements with the ampere balance, made in connection with experiments on the Schuster magnetometer, the probable error in the determination of the ampere was found to be about four parts in 100,000. The loss of accuracy is due to some deterioration, with lapse of time, in the insulating material employed, and the construction of new cylinders for the balance, in which the use of paraffin wax insulation is avoided, has been undertaken. A second Schuster magnetometer is being constructed, at the request of the Astronomer Royal, for use at the Greenwich Observatory.

Considerable progress has been made with the provision of standards for radio work, at the request of the Radio Research Board. A method of maintaining accurately the constancy of the wave length in transmission has been devised by Mr. Dye which promises to have important applications. Experiments are proceeding on the properties of iron at radio and acoustic frequencies. The experiments on the variation of the bearing of fixed stations, and the measurements of signal strength are being continued. Apparatus has been devised by Mr. Hollingworth for measuring the intensity of received signals, with which interesting results have been obtained. The Electrical Measurements Division has a considerable amount of work in hand for the Electrical Research Association, and for the Admiralty, including the investigation of dielectric losses at high frequencies. Some interesting results have been obtained in the investigation of hysteresis and eddy current losses in sheet steel.

In the Electrotechnics Department the demands for investigations involving large voltages and currents continue to increase, and additional and larger generating and transforming plant is being installed. Preliminary work has been done on the measurement of small amounts of power by means of an electrometer designed to operate at high voltages. The instrument has been employed in the measurement of the energy lost in insulating materials, an investigation undertaken for the Electrical Research Association, and it is hoped that it will operate at the highest commercial voltages at present in use.

Assistance has been given to the Electrical Research Association in connection with many of its investigations. Among the more interesting is an examination into the effects of the rupture of short circuit conditions by oil-immersed switches when controlling very large amounts of power. In addition to advice on electrical measurements, apparatus has been developed for recording the hydrostatic pressure generated at various points in the surrounding oil at the moment of operation. Several types of supply meters are being investigated on behalf of the Electricity Commissioners, who act as approving authority under the regulations previously exercised by the Board of Trade.

In the direct current section a considerable number of special investigations are proceeding for different bodies and private firms. The resistivity of porcelain has been investigated for temperatures up to 1,200 deg. C., and the polarisation effect determined with both alternating and direct current measurements. Experiments on fuses have been reported upon and experiments on accumulators have been made for the Chemistry Research Board. Various investigations relating to cables are in hand for the Admiralty. Experiments have been carried out with a view to international agreement as to the figure to be adopted for the resistivity of aluminium of high commercial purity.

In the photometry section, the work on ships' navigation lights has continued, An experimental building has been erected for the investigation, by means of scale models, of problems in the natural and artificial lighting of buildings.

In the engineering department the main work of the year has been the research on lubrication carried out for the Lubrication Research Committee. A research on turbine blading materials is in progress for the Electrical Research Association. Experiments on tramcars for the London County Council, and at Wigan, appear to show, as reported in our pages some time ago, that a saving of about 30 per cent. in power can be effected by the introduction of roller bearings.

In the metallurgy department research on ferrous alloys has been commenced for the Alloys Research Committee. The alloys are prepared in a carbon ring electric furnace and the first problem was to prevent contamination of the iron by the carbon of the furnace. For this purpose a muffle has been used glazed with a highly refractory glaze, fired on at a temperature of 1,530-1,560 deg. C., but it has several defects and further expedients are being tried. An electrolytic process has been used to obtain iron of the exceptionally high degree of purity required. The research on the cracking of boiler plates for the Engineering Research Board has been continued. No failure has occurred in specimens submitted to prolonged stress for two years at 300 deg. C., although the stress was above the elastic limit: It appears probable that some corrosion must occur to cause cracking. Additions to the equipment include a 25-kilowatt Ajax-Northrup induction furnace.

Important additions to the equipment for aeronautics research included a one-fifth scale model of a Bristol fighter, large enough to admit a small electric motor to drive the airscrew inside the fuselage for the first time. The motor, which we described some time ago, was designed and constructed at the laboratory.

(To be continued.)

LEGAL.

H.M. Postmaster-General v. Beck & Pollitzer.

IN the Mayor's and City of London Court, on June 26th, Judge SHEWELL COOPER delivered a considered judgment in a case of much importance in which the Postmaster-General made a claim against Messrs. Beck & Pollitzer, wharfingers, for £15 16s. 9d., under Section 8 of the Telegraph Act, 1878, the amount of expenses incurred by him in making good a destruction caused to a telegraph line on the pavement of Gallions Road, North Woolwich, by the defendants on November 10th. Mr. Harold Murphy appeared for the Postmaster-General and Mr. J. B. Matthews, K.C., and Mr. T. Scanlan for the defendants. Defendants admitted that their servant acting in the course of his duty drove a motor lorry along the highway into contact with a fire alarm post which formed part of the telegraph line in question and injured it, but they denied that their man was in any way negligent.

Mr. MURPHY said that the Postmaster-General's view of the construction of the Telegraph Act was that it was not necessary to show negligence.

Mr. J. B. MATTHEWS, K.C., said that there had been conflicting decisions on the question, but the law would not, he hoped, be so revolutionised as to hold people liable for acts when there was no negligence established. The case was of the greatest possible public importance. Hundreds of similar accidents had been happening since 1878, when the Telegraph Act was passed; but it was only recently that the "brilliant" idea had been put forward of seeking to inflict liability.

Judge SHEWELL COOPER said, having regard to the great importance of the case, he had reserved his judgment. He found for the Postmaster-General and gave him costs on the higher scale because of the importance of the case.

Gilson v. Brinsley's—New Trial.

IN the Mayor's and City of London Court, on June 28th, application for a new trial and the setting aside of a judgment for £94 in favour of plaintiffs, was made to Judge Shewell Cooper by the defendants, Brinsley's, electricians.

Mr. ROBERTSON, in making the application, said that the defendants' business was managed by a Miss Ainge, who was on terms of intimacy with a man named Garde. The latter, unknown to defendants, had been allowed to carry on business as an electrical engineer in part of defendants' premises. In March the plaintiffs issued a writ and it was served on somebody at defendants' premises. That person instructed a solicitor named Chinner to act, and when the case was tried he submitted to judgment for plaintiffs on agreed terms. Capt. McEachern, who had acquired the business of Brinsley's, had no knowledge of Garde at the time, but later discovered him and ejected him from the premises. Garde had sworn affidavits deposing that he was authorised to act on behalf of the defendants. The judgment thus obtained was invalid and could not stand, although plaintiffs had done nothing wrong in the matter, having been misled. They should recover their costs from the solicitor Chinner.

Mr. DYER, K.C., for plaintiffs, urged that Miss Ainge had an implied authority to employ Chinner. Defendants should pay plaintiffs' costs and claim them from Chinner.

Judge SHEWELL COOPER said that he must set aside the judgment, and he would reserve all the question of costs so that Chinner could attend and be heard.

Thrige v. United Shipping Co., Ltd.

IN the Commercial Court of the King's Bench Division, on June 27th, Mr. Justice Rowlatt had before him an action in which Mr. T. B. Thrige, of Odense, Denmark, claimed damages from the United Shipping Co., Ltd., of Fenchurch Street, E.C., for alleged breach of duty in the delivery of electrical machinery; or alternatively, damages, or conversion. Defendants denied liability.

Mr. Beresford, in opening the case, said the plaintiff manufactured electrical machinery which was sold in this country. The defendants were forwarding agents for a firm in Denmark called Det Forenede Dampskibselskabet. The plaintiff was for some time prior to 1917 dealing with a company, the Victoria Dynamo & Motor Co., with offices in Kingsway; large quantities of machinery were supplied by the plaintiff to these people, and in 1917 they were indebted to Mr. Thrige to a considerable extent. He then made arrangements that they were to be supplied only against cash against documents, and from 1917 onwards up to the present time it was believed by the plaintiff that the goods were only being taken up in that way. What happened was that the goods came across to this country shipped by the Forenede Co. to their agents the United Shipping Co. They were shipped on bills of lading, and when they came to Harwich apparently the defendants took possession of the goods. They sent them to London, and there, apparently without any demand for any documents to be produced, the goods were handed over to the Victoria Dynamo Co. That appeared to have gone on for a considerable time, Mr. Thrige not discovering it because he imagined that his goods were still in the possession of the defendants or the railway company, for the documents to be taken up. With regard to the method adopted by him, he dispatched the goods from Esbjerg to the Forenede people, but asked that they should make out duplicate bills of lading, and send them to him, and at the same time advise his bank in Denmark, which in turn advised its London agents, Hambro's Bank, that the documents were coming forward. When the documents came to Hambro's Bank a representative took them to the Victoria Dynamo Co., and if the company was in a position to take up the documents, it did so; if not, the documents were returned to the bank until the company was ready to take them up. The plaintiff's case against the defendants was that they had wrongfully handed over his goods without receiving the documents. The Victoria Dynamo Co. got the goods, and had ceased to function, and the plaintiff had not received his money.

Mr. MILLER, K.C., for the defence, contended that his clients had been wrongly sued, as the order was to take the goods to London and hand them to the Victoria Dynamo Co. The defendants never really had custody or control of the goods, and owed no duty to the plaintiffs.

HIS LORDSHIP, giving judgment after hearing evidence, said the defendants had to handle the traffic at Harwich, and they were to be paid commission. When the goods arrived at the railway company's wharf, the railway company would have no knowledge of what to do with them, and the intervention of the defendants was necessary. The defendants supplied certain information, and it seemed to him that they were more than mere agents or a conduit pipe in the matter. If the defendants had not sent the goods on, nobody else would have done so, and he thought, upon the whole, the defendants were in a position that they could be held liable. It was not a case of conversion, because all they did was to omit to take certain precautions. He thought that judgment should be for the plaintiff for the invoice value of the goods.

Counsel said the sum was £1,577.

His Lordship entered judgment for the plaintiff accordingly, and granted a stay of execution.

British Thomson-Houston Patents.

THE British Thomson-Houston Co., Ltd., on Friday, June 29th, obtained an interim injunction restraining C. Ridley, of Dundas Mews, Middlesbrough, from selling incandescent electric lamps which infringed its patents for gasfilled lamps, and from parting with any of the alleged infringing articles.

The application was made *ex parte* to Mr. Justice Russell, in the Chancery Division; by Mr. Trevor Watson, who said the reason for the second part of the injunction was that in many of these cases the lamps were imported, and as soon as the notice of motion was served, the defendants sent the lamps back to the foreign makers, with the result that the plaintiffs were left without any remedy at all.

HIS LORDSHIP also granted leave to serve notice of motion on the defendant for to-day, Friday.

Accumulators of Woking, Ltd., v. Higgins, Ltd.

MR. J. A. SCOTT, one of the High Court Official Referees, on July 3rd, heard an action in which the plaintiffs claimed £174 from defendants, of Deansgate, Manchester, balance of account for goods supplied.

Mr. TURNBULL, appearing for the plaintiffs, said that a defence had been put in in which certain cross-claims were made. These had been the subject of much negotiation between the parties, and the result was that everything had been agreed except with regard to one particular item of £87 2s. and a small sum of £2 8s. The claim arose upon the supply of two accumulators by the plaintiffs to a sub-purchaser on the defendants' behalf. The defence, said counsel, was not that the price was excessive, but that the accumulators supplied were defective, and that defendants were not bound to pay for them in consequence. The sub-purchaser was not satisfied with the batteries, and insisted upon defendants replacing them. The question for the Court was really whether they were according to contract, and defendants counter-claimed for £36 11s.

In reply to the REFEREE, counsel said that the purchase was at an agreed price, and as to that there was no dispute.

The OFFICIAL REFEREE: In that case the onus is upon the defendants to prove their case.

Mr. E. W. WINGATE-SAUL, K.C., for the defendants, said that the order was given for a lighting set for the Denton Fur Cutting Co., and the battery consisted of 64 cells, which were fitted into a stand. The plaintiffs were asked to supply a sketch of the stand for the battery, and they did so. The cells were not arranged in an ideal manner in the stand, but were back to back instead of end to end, and there was not sufficient room to arrange the cells, and they could not all be got in. The battery was put into working order as soon as it arrived—at the beginning of December, 1920. After it had been at work for about a month it was found that two of the cells were very defective. The plaintiffs were communicated with, and they said they would send down Mr. Butterworth, who would see if there were any grounds for the complaint. He went down and inspected the cells, and agreed that they were defective. He said that if they were sent back, the plaintiff company would correct them. He also said there were signs of something not being quite right with the other

cells. After Mr. Butterworth's visit, a letter was written on February 17th, 1921, to the defendants, and a correspondence followed, in the course of which it was said that the battery had been connected up in a reverse position, and for that reversal plaintiffs did not accept responsibility.

Mr. Turnbull (for the plaintiffs): The plates were all right if they had been properly handled.

Mr. Wingate-Saul: By the reversal negative plates were turned into positive plates. The defective plates were taken away and replaced by new ones, and the claim of £23 represented those plates.

Mr. Exley, an expert witness called in support of defendants' case, said that he inspected the battery in July, and admitted that he could not point to any objective sign of the battery having been worked in a reverse direction, although he mentioned that it had been so worked at some time or other.

Mr. Frede. Wm. Burthorn, of the Palatine Accumulator Co., of Manchester, inspected the battery in September, 1921, and found that some of the cells were going. Some were feeble and some were practically dead. The dead cells had a large amount of deposit at the bottom from the broken positive plates. The specific gravity of the acid in the cells was too low, the effect of which was to reduce the capacity of the cells.

At the close of this witness's evidence, a consultation took place between the parties, and after a short adjournment, counsel announced that an agreement had been come to by which judgment would be taken for the plaintiffs on the claim for £100 with costs, and there would be no order as to the counterclaim. That, added counsel, would settle all matters between the parties.

Judgment was entered accordingly.

CORRESPONDENCE.

Letters received by us* after 5 p.m. on Tuesday *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Patents and Inventions.

In your last issue "Twiceshy" echoes the warning of a previous article, and asks what can be done to remedy the state of things therein outlined.

At present the public is far too conventional to think of anything until it is commercialised or to ask for anything until it happens to be on the menu. The retailer is dependent on the manufacturer and is much more likely to push a stock line than interpret this customer's needs; therefore the inventor approaches the manufacturer direct, only to find that his roads are up and he is surrounded by red lights.

The remedy for this is in the hands of the associations separately representing the public, the retailers, and the manufacturers, and their co-operation with an association of inventors.

Facilities should be provided for free exhibition by inventors of approved inventions. These bodies should be supplied with brief particulars classified under trades, and with reference to such serially-filed details as the inventor in each case cares to supply. I do not see why various trade organisations should not combine to secure these privileges and aid in making the inventors' bureau a place worth visiting at frequent intervals. Retail associations should invite exhibition of new devices not yet marketed, so that the inventor can invite inquiries and provisional orders from those interested. This would be a valuable aid to the inventor in sounding his invention and in proving to the manufacturer that it is marketable, while the prospective customer would be placed at the top of the list for approach when the first supply is available.

Organisation is necessary to inventors in order to provide themselves with facilities for private interviews as well as storage of inventions for a limited period. Thus, the inventor of an improved billiard table, for instance, would not have to run it round London, or the inventor of an electrical device would not have to make as many models as there are systems of electricity supply. A list of firms willing to receive particulars of new inventions and to subscribe a small fee as a *bona-fide* to that end, should be kept on file for reference. Any firm objected to on good grounds, by a member, should be ruled out of future lists. This would serve as some protection, and the publicity among the fraternity would deter firms that had no scruples when dealing with isolated individuals. Such matters are of more importance to inventors than the privilege of having their specifications buried in a filing system while they imagine that their business is under attention.

As regards the evils of the patent system in this country, the most obvious is that the inventor is dependent for advice on patent agents and their literature, which latter is distorted by the vision of fees. Secondly, the Patent Office is not primarily designed for the benefit of the inventor or of industry. It is a business in itself, as profitable as a toll-gate would be at the busy end of Cheapside; that is, until Cheapside ceased to be busy. It is a source of revenue that should appeal to any shrewd politician with an eye to economy stunts. I hear that work there is still delayed by a depleted staff, and that any increase is taboo, as this department is not prominent in the public mind. We are behind Germany and America in our patent procedure. The Patent Office holds up for at least twelve months all attempts to deliver new goods. This forces inventors to prepare foreign applications before the British ones are accepted, which is a great advantage to the patent agent in case the British rights prove worthless. However, I will not continue, as I suppose such evils are inherent in the system, and will die a natural death when the perfect Government grasps its own limitations and invents a new Ministry of Commonsense.

Whatever is done for invention in the future organised British industry will be very short-sighted and ungrateful if at the coming Empire Exhibition it does not reserve a little free space for the poor inventor.

June 30th, 1923. **M. I. P.**

Municipal Trading.

With reference to the paper read by Mr. Hall before the I.M.E.A. at Scarborough, which was abstracted in your issue of June 22nd, does not this suggestion have a very strong tendency to introduce the old question of municipal trading at the expense of the existing electrical factor? Having got the thin end of the wedge in, it would appear to be only a question of time before factors will be frozen out, and, in consequence, contractors will be compelled, sooner or later, to obtain the whole of their supplies through a municipal undertaking.

If this is allowed to continue, what prospect has a factor (although he may have a very fine and up-to-date show room) in attempting to compete against a municipal concern, which has the rates behind it for financial backing, and may be in a position to offer the contractor very tempting terms for business?

Is this not a question that could with advantage be taken up with the manufacturers and factors, who, in co-operation, should be in a position to remedy this unsatisfactory state of things?

It would be interesting to hear what the electrical factors, in and around Burton, have to say; also, whether the undertaking purchases through their organisation, or from the manufacturer direct.

Is it not a question of

June 25th, 1923. **Live and Let Live?**

A Motor Query.

With reference to "G.W.'s" inquiry, under the above heading, the writer is of the opinion that his trouble is due to either an uneven or too large an air gap. With an a.c. machine this has a tendency to reduce the power and the starting torque. On the other hand, a partially short-circuited coil would cause the motor to have a pronounced "beat" when running. Unfortunately "G.W." does not state the size of the existing air gap, or what it was originally.

Cardiff, *July 2nd*, 1923. **C. A. Besley.**

C.T.S. Wiring in Workshops.

I have had quite a lot to do with C.T.S. wiring, and have become very much impressed with its supreme excellence for a large number of jobs.

I find, however, that in spite of the satisfactory behaviour of this material, difficulty is found in obtaining permission to use it in workshops and other places where medium pressures are used, the preference being for screwed conduit.

Now, I have installed C.T.S. with the greatest satisfaction in places where screwed conduit, carefully installed, has failed on both low- and medium-pressure circuits, and I cannot understand why so many authorities specify screwed conduit, to the exclusion, of course, of C.T.S. There are no Government Regulations to bar C.T.S., as regulation No. 2 of the Factory Wiring Act is quite open on the matter, and I know of several C.T.S. jobs done under such circumstances that have been seen and approved of by H.M. Inspectors.

Perhaps some of your readers may have special knowledge on the matter, and I, for one, would be glad to have such information as would save me any further trouble in arranging for C.T.S. wiring, where I am faced by local regulations of the old-fashioned kind that seem to bar its use in favour of the conduit system, which, in my opinion, is not the equal of C.T.S. in almost any respect, except perhaps with regard to the possibility of deliberate and wilful cutting.

London, *July 2nd*, 1923. **Philippe E. Peronne.**

[Certain municipal electricity supply undertakings have secured power to issue regulations which must be complied with in installations connected to their mains. The vast majority, however, and all companies supplying electricity, have no legal power to specify any material or fitting whatever; if the insulation resistance is up to statutory requirements, and there is no reason to anticipate that the installation will cause interference with the supply to other consumers, they are bound to connect the installation to their mains.—Eds. Elec. Rev.]

NEW PATENTS APPLIED FOR, 1923.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. SEFTON-JONES, O'DELL AND STEPHENS, Patent Agents, 285, High Holborn, London, W.C. 1.

15,729. "Determining positions of ships, aircraft, &c., by wireless signals." R. W. Anstey. June 18th.
15,734. "Electric conduit tubes." R. W. Perry. June 18th.
15,736. "Rotors of dynamo-electric machines." C. P. Bramley and Lancashire Dynamo and Motor Co., Ltd. June 18th.
15,738. "Electric contact maker." G. H. Atkin. June 18th.
15,764. "Apparatus for crystal reception of wireless telegraphy, &c." Apex Radio Co. and H. Houghton. June 18th.
15,765. "Sound-distributing device for use with telephone receivers." A. B. Johanning. June 18th.
15,770. "Terminal or junction box for insulated high-tension cables." Forges et Ateliers de Constructions Electriques de Jeumont. June 18th. (France, July 26th, 1922.)
15,777. "Current-collecting devices." Metropolitan-Vickers Electrical Co., Ltd. June 18th. (United States, July 5th, 1922.)
15,779. "Multiple two-way switches." O. D. Edmonds and E. A. Sennitt. June 18th.
15,782. "Crystal detectors for wireless telegraphy, &c." G. T. Gurr. June 18th.
15,791. "Electrical appliances in moulded glass." L. Sanchez-Vello. June 18th. (France, June 23rd, 1922.)
15,806. "Variometers and variocouplers." Igranic Electric Co., Ltd., and F. Noble. June 18th.
15,807. "Electrostatic voltmeters." R. W. Lunt. June 18th.
15,810. "Telephone earpieces." J. Wace. June 18th.
15,811. "Tramway, &c., vehicles." W. J. Jones. June 18th.
15,856. "Electric switches." Cable Accessories Co., Ltd., and A. Crawford. June 19th.
15,860. "Electric switches." F. H. Green. June 19th.
15,869. "Swivel joints for electric leads." J. E. S. Trelawney. June 19th.
15,871. "Wireless receiving set." W. J. Hunt and R. H. Lewis. June 19th.
15,873. "Oil-immersed electric switch fuses." H. W. Clothier and J. Mirrey. June 19th.
15,880. "Amplification of sound." C. A. Squire. June 19th.
15,885. "Electric relays." A. E. Angold, A. H. Railing and W. Wilson. June 19th.
15,892. "Holder, &c., for electric lamps or valves." M. Cooper, H. T. C. Electrical Co., C. F. Hurst, and A. H. Triggs. June 19th.
15,893. "Wireless receiving set." G. E. Nash and Western Electric Co., Ltd. June 19th.
15,894. "Telephone systems." Western Electric Co., Ltd. (G. Deakin). June 19th.
15,895. "Fuses for vacuum tubes, &c." M. B. Cohen. June 19th.
15,901. "Vacuum electric tubes." E. Y. Robinson. June 19th.
15,902. "Vacuum electric tubes." E. Y. Robinson. June 19th.
15,911. "Wireless transmission and augmentation of energy for power purposes." H. Kirschfeldt. June 19th.
15,916. "Electric conductors." Felten & Guilleaume Carlswerk Akt. Ges. (Germany, July 7th, 1922.) June 19th.
15,924. "Thermionic valves." J. P. Prangnell. June 19th.
15,933. "Receiving systems for electromagnetic waves, &c." Marrec, Ltd., and Y. Marrec. June 19th.
15,934. "Tuning wireless circuits." C. G. Styles and H. G. Styles. June 19th.
15,941. "Means for making tests in electrical apparatus, &c." H. A. H. Nijland. June 20th.
15,947. "Ventilation of electrical, &c., machines." G. H. Walker and Heenan & Froude, Ltd. June 20th.
15,974. "Electrode or pole for electrolytic cells." S. Kotera. June 20th.
15,976. "Valve holders for wireless telephony, &c." A. C. D. Smith. June 20th.
15,979. "Electromagnetic control devices." English Electric Co., Ltd., and T. Zweigbergk. June 20th.
16,000. "Wire-drawing machines." Western Electric Co., Ltd. (Western Electric Co., Inc.). June 20th.
16,007. "Control systems for automatic sub-stations." R. C. Arter. June 20th. (United States, July 24th, 1922.)
16,008. "Control systems for generating stations." R. C. Arter. June 20th. (United States, July 24th, 1922.)
16,014. "Thermionic valves." C. S. Franklin. June 20th.
16,025. "Wireless set." S. R. Quigley. June 20th.
16,028. "Manufacture of electric incandescent lamps, &c." General Electric Co., Ltd. June 20th. (Germany, January 5th.)
16,029. "Illuminated signs." General Electric Co., Ltd. June 20th. (Germany, October 11th, 1922.)
16,031. "Electric translating devices." W. M. Bruce. June 20th.
16,032. "Well-casing elevators." Dunn Manufacturing Co. June 20th.
16,034. "Tape-pasting device." Kleinschmidt Electric Co., Inc. June 20th. (United States, June 28th, 1922.)
16,036. "Dynamo-electric machines." British Thomson-Houston Co., Ltd. (General Electric Co.). June 20th.
16,037. "Flashing electric signs." F. G. Galley and G. P. Kent. June 20th.
16,038. "Thermionic valve circuit." O. J. Lodge and E. E. Robinson. June 20th.
16,046. "Diaphragms." O. Y. Imray (Radiotive Corporation). June 20th.
16,047. "Illuminated signs." General Electric Co., Ltd. June 20th. (Germany, February 15th.)
16,050. "Chains for suspending electric light bowls." F. Stokes. June 21st.
16,051. "Sparking plug conductor attachments." H. G. Longford. June 21st.
16,062. "Wireless receiving apparatus." H. L. Wood. June 21st.
16,066. "Telephone connections." R. Whaley. June 21st.
16,074. "Terminal for electrical instruments." W. H. Brown. June 21st.
16,081. "Variable condenser." R. J. Gomley. June 21st.
16,095. "Telephone receivers." C. J. Coleman. June 21st.
16,096. "Wireless telephony, &c." C. J. Coleman. June 21st.
16,101. "Electric connectors, terminals, &c." R. O. McGown. June 21st.
16,103. "Apparatus for reception of wireless signals, &c." H. A. Madge. June 21st.
16,133. "Electric condensers." N. P. Hinton and Metropolitan-Vickers Electrical Co., Ltd. June 21st.
16,135. "Device for testing electric safety fuses." J. Bär. June 21st. (Switzerland, September 14th, 1922.)
16,137. "Wireless telegraphic, &c., apparatus." R. R. Osman. June 21st.
16,146. "Insulating protecting covers for conductor rails." Electric Traction Developments, Ltd., and E. H. Smythe. June 21st.
16,147. "Discharge tubes." Naamlooze Vennootschap Phillips' Gloeilampenfabrieken. June 21st. (Holland, June 21st, 1922.)
16,153. "Compensation of variations in periodicity of vibrating reeds, &c." Eastern Telegraph Co., Ltd., and H. V. Higgitt. June 21st.
16,161. "Electric retardation lines." W. J. Mellersh-Jackson (Submarine Signal Corporation). June 21st.
16,169. "Registering mechanism." British Thomson-Houston Co., Ltd. (General Electric Co.). June 21st.
16,170. "Automatic electric regulators." British Thomson-Houston Co., Ltd., R. D. Parry, and H. Trencham. June 21st.
16,173. "Sound-producing devices." W. J. Mellersh-Jackson (Submarine Signal Corporation). June 21st.
16,174. "Electrically insulating wire." C. W. Laird (Menteyne). June 21st.
16,178. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. June 21st. (United States, August 25th, 1922.)
16,179. "Aerials for wireless signalling." C. S. Franklin. June 21st.
16,184. "Apparatus for detecting underwater sounds." W. J. Mellersh-Jackson (Submarine Signal Corporation). June 21st.
16,188. "Sound-receiving devices." W. J. Mellersh-Jackson (Submarine Signal Corporation). June 21st.
16,191. "Signalling by oscillations of audible frequency." Submarine Signal Corporation. June 21st. (United States, November 11th, 1922.)
16,198. "Electric switches." J. H. Boyd and W. C. Rouse. June 22nd.
16,207. "Supports for wireless panels." O. E. Wheeler. June 22nd.
16,220. "Rotary-current distributors." H. B. Stocks and H. R. Stocks. June 22nd.
16,227. "Induction motors." H. Green. June 22nd.
16,231. "Current-collecting devices." Metropolitan-Vickers Electrical Co., Ltd. June 22nd. (United States, July 5th, 1922.)

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1921.

33,160. "Electric transformers." E. Vedovelli. December 9th, 1921. (198,714.)
33,430. "Magneto-electric ignition apparatus." R. Bosch Akt. Ges. December 13th, 1920. (172,957.)

1922.

821. "Production of thermo-induction currents." E. Vix and M. Meinhardt. January 10th, 1922. (198,722.)
1,500. "Burglar alarms." J. R. West. October 17th, 1922. (198,734.)
3,134. "Magnetos." F. L. Hollister and C. A. Vandervell & Co., Ltd. February 2nd, 1922. (198,735.)
3,280. "Electric motors." Lancashire Dynamo and Motor Co., Ltd., and R. S. McLeod. February 4th, 1922. (Addition to 175,355.) (198,736.)
6,101. "Electric cables or conductors." H. C. Braun. March 1st, 1922. (Cognate application, 14,622/22.) (198,739.)
6,151. "Combined electric cooker and water-heater apparatus." T. R. Stancombe. March 2nd, 1922. (198,740.)
6,205. "Means for supporting and insulating conductors of electric overhead distribution or transmission lines of comparatively low voltage." G. V. Twiss. March 2nd, 1922. (198,742.)
6,561. "Electrical burglar alarm systems and the like." J. F. Broom. March 6th, 1922. (198,755.)
6,574. "Generation of high-frequency electric oscillations." Marconi's Wireless Telegraph Co., Ltd., E. W. B. Gill, and J. H. Morrell. March 6th, 1922. (198,757.)
6,715. "Means for obtaining the polar diagram of an alternating electromotive force or current." J. T. MacGregor-Morris and F. R. F. Ramsay. March 7th, 1922. (198,765.)
6,821. "Electrically-propelled vehicles." L. B. Hewitt and Metropolitan Electric Tramways, Ltd. March 8th, 1922. (198,769.)
6,857. "Electricity meters." R. Amberton. March 8th, 1922. (Cognate application, 11,363/22.) (198,772.)
6,875. "Safety devices for the lighting of vehicles." L. Renault. December 8th, 1921. (190,100.)
6,898. "Automatic telephone systems." Relay Automatic Telephone Co., Ltd., and E. J. C. Rousseau. March 8th, 1922. (198,776.)
6,904. "Discharge tubes for use in converting sound waves into light variations." T. H. Nakken. March 9th, 1921. (176,796.)
7,125. "Protective arrangements for alternating-current electric circuits." A. Reyrolle & Co., Ltd., and R. W. Biles. March 10th, 1922. (198,788.)
7,364. "Appliances for increasing the audibility of telephones, gramophones, and such like wire and wireless phonetic apparatus." Baron Clifford of Chudleigh (W. H. Clifford). March 13th, 1922. (198,799.)
7,366. "Electric furnaces." L. W. Wild and E. P. Barfield. March 13th, 1922. (198,800.)
7,621. "Electric cells." Soc. Anon. Le Carbone. June 3rd, 1921. (180,982.)
7,622. "Wet electric cells." Soc. Anon. Le Carbone. December 9th, 1921. (190,101.)
7,632. "Glass electrodes for high-frequency electric currents." W. H. Gwynn. March 15th, 1922. (198,811.)
7,807. "Head lamps for motor vehicles and the like." E. T. Sweeney. March 17th, 1922. (198,816.)
9,179. "Electric switches." M. J. Railing, T. Taylor, and F. J. Holton. March 30th, 1922. (198,847.)
9,384. "Sparking plugs for internal-combustion engines." J. H. Chapman. April 1st, 1922. (198,852.)
10,215. "Long-distance telephone installations." Soc. d'Etudes pour Liaisons Téléphoniques et Télégraphiques à Longue Distance. July 8th, 1921. (182,767.)
11,396. "Overhead constructions for carrying electric conductors and the like." J. T. Thompson. April 22nd, 1922. (198,868.)
11,600. "Electric heating units." British Thomson-Houston Co., Ltd. (General Electric Co.). April 25th, 1922. (198,872.)
14,030. "Radio receiving systems." British Thomson-Houston Co., Ltd. May 18th, 1921. (180,332.)
14,205. "Oil-insulated switchgear and like enclosed electrical apparatus." G. Ellison and J. Anderson. May 19th, 1922. (198,893.)
14,438. "Electric furnaces." L. W. Wild and E. P. Barfield. May 22nd, 1922. (198,898.)
16,518. "Polyphase electric transformers." Pittsburgh Transformer Co. and S. Horelick. June 14th, 1922. (198,911.)
16,701. "Electrically-operated illuminated signs for advertising and like purposes." S. T. Hosken. June 16th, 1922. (Cognate application, 28,571/22.) (198,913.)
16,729. "Recording meters, particularly applicable to electricity meters." Landis & Gyr Akt. Ges. June 20th, 1921. (181,726.)
18,734. "Regulating apparatus for dynamos." Ward Leonard Electric Co. and F. H. Bullinger. July 7th, 1922. (198,923.)
19,032. "Thermal switch adaptor or coupling unit for incandescent electric lamps." F. H. Eeles and H. M. Edwards. July 11th, 1922. (198,927.)
20,209. "Electric heating units." British Thomson-Houston Co., Ltd. (General Electric Co.). July 24th, 1922. (198,932.)
20,351. "Electrodes and method of making same." J. P. Scott. July 25th, 1922. (198,933.)
21,475. "Safety devices for electrical apparatus." M. Buchholz. August 5th, 1922. (198,936.)
24,633. "Electric rectifiers and methods of operating the same." Naamlooze Vennootschap Phillips' Gloeilampenfabrieken and Dr. G. Holst. September 11th, 1922. (198,950.)
29,769. "Sockets for electric incandescent lamps." General Electric Co., Ltd. (Hall Switch and Signal Co.). October 31st, 1922. (198,963.)

1923.

6,628. "Submarine telegraphy." E. S. Heurtley. September 1st, 1922. (Divided application on 32,159/21.) (198,978.)